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DISTRIBUTION OF HOUSEHOLD WATER TREATMENT THROUGH MUTUAL HEALTH ORGANIZATIONS:
RESULTS FROM A PILOT PROJECT IN RWANDA

October 2010

This publication was produced for review by the United States Agency for International Development. It was prepared by Slavea Chankova, Damascene Butera, and Laurel Hatt (Abt Associates Inc.); and Sabine Musange (School of Public Health, National University of Rwanda) for the Social Marketing Plus for Diarrheal Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN) project.

POUZN
POINT-OF-USE SAFE WATER & ZINC SAVING CHILDREN'S LIVES

This assessment was made possible through support provided by the United States Agency for International Development (USAID) and the Social Marketing Plus for Diarrheal Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN) Project. Contract No.: GPO-I-00-04-00007-00 TASK Order 5

Recommended Citation: Chankova, S., Butera, D., Hatt, L., and S. Musange. 2010. Distribution of Household Water Treatment through Mutual Health Organizations: Results from a Pilot Project in Rwanda. Bethesda, MD: Social Marketing Plus for Diarrheal Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN) Project, Abt Associates Inc

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Contract/Project No.: GPO-I-00-04-00007-00 TASC Order 5

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Social Marketing Plus for Diarrheal Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN) Project

Health Systems 20/20 Project

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ACRONYMS

CHW	Community Health Worker
CTAMS	*Cellule Technique d'Appui aux Mutuelles de Santé* (Health Scheme Technical Support Unit)
DHS	Demographic and Health Survey
DID	Difference in Difference
HH	Household
HMIS	Health Management Information System
IPC	Interpersonal Communication
MHO	Mutual Health Organization
MOH	Ministry of Health
NGO	Nongovernmental organization
ORS	Oral Rehydration Solution
POS	Point-of-sale
POU	Point-of-use
POUZN	Social Marketing Plus for Diarrheal Disease Control: Point-of-Use Water Disinfection and Zinc Treatment Project
PSI	Population Services International
RWF	Rwandan Franc
USAID	United States Agency for International Development

ACKNOWLEDGMENTS

The work reported here was supported by funds from the U.S. Agency for International Development (USAID) through the Health Systems 20/20 Project and the Social Marketing Plus for Diarrheal Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN) Project.

This evaluation was a collaborative effort between researchers based in Rwanda and the United States.

The Rwanda Ministry of Health, the National Institute of Statistics, and the National Research Ethics Committee reviewed and granted approval of the study.

The authors of this report wish to thank several people for their support of the evaluation and contributions to the research design, data collection, data analysis, and production of this report. We thank Hertilan Inyarubuga and Damien Iyakaremye from CTAMS for their support and valuable insights. Special thanks to the district health staff and managers at the mutuelle district and section level in Nyagatare, Rubavu, and Karongi who shared their experience and opinions, and provided information used in this evaluation. Dr Emilien Nkusi of the Ministry of Health provided the HMIS data used in the analyses. We thank Dr. Ignace Rwakayiro for his supervision of the household data collection and data entry process, and the dedicated team of data collectors and supervisors who gathered the household survey data for the study.

Many individuals from Health Systems 20/20 and POUZN supported this research project from the beginning, including: Marty Makinen, Cheikh Mbengue, Susan Mitchell, Vicki MacDonald, and Catherine Connor. We thank K.P. Srinath, Ken Carlson, and Jacob Klerman for their advice on the sampling and analytic approach. Rob Quick of the Centers for Disease Control, John Borrazzo and Rochelle Rainey of USAID provided valuable comments to an early presentation of the study results.

Population Services International in Rwanda provided invaluable support with logistics for conducting the evaluation - we are particularly grateful to Andrea Plautz and Imelda Muhuza, as well as to Giovanni Dusabe, Justin Buszin, and Megan Wilson. Finally, we thank Maria Claudia De Valdenebro for production of this report.

EXECUTIVE SUMMARY

INTRODUCTION

Mutual health organizations (MHOs) are voluntary community-based health insurance organizations that focus on informal sector, low-income populations. MHOs are a promising channel for reaching these target groups with preventive health messages and products. However, MHOs have rarely been tapped for the promotion and distribution/sale of preventive health products, and there is limited evidence on the impact of such interventions.

In Rwanda, MHOs (called *mutuelles de santé*) covered 85 percent of the population in 2008. Diarrheal disease is one of the leading causes of death for Rwandan children. Unsafe water and poor hygiene and sanitation are major contributors to diarrhea prevalence. While there is overwhelming evidence that point-of-use (POU) water treatment reduces diarrhea prevalence, use of POU treatment in Rwanda is very low. In 2007, two global projects sponsored by the United States Agency for International Development (USAID), Health Systems 20/20 and Social Marketing Plus for Diarrhea Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN) partnered with the Rwandan Ministry of Health and mutuelles in two districts in Rwanda to implement a pilot project to promote and distribute Sûr'Eau, a low-cost liquid chlorine-based water disinfectant, through the mutuelles and community health workers (CHWs).

PROJECT DESCRIPTION

The pilot project aimed to increase use of *Sûr'Eau* in *mutuelle* households. Increased use of the product was expected to lead to decreased prevalence of diarrhea, and lower costs for diarrhea treatment for the mutuelles. This, in turn, would provide further incentive for *mutuelles* to institutionalize the intervention and consider including similar distribution of other health promotion products for their members.

Sûr'Eau has been available in Rwanda since 2002, sold through health centers and commercial outlets throughout the country at a price of RWF 300 ($0.55) per bottle. A bottle can treat the drinking water of a family of four to five members for about six weeks. Nationwide promotion of *Sûr'Eau*, conducted by Population Services International/Rwanda, has relied on a social marketing approach. However, use of the product in poor rural communities has remained low.

The pilot project was implemented from December 2007 until August 2009 in Nyagatare and Rubavu, two rural districts known for frequent cholera outbreaks. Key implementing partners were Population Services International (PSI), the department for *mutuelles* technical assistance at the Rwandan Ministry of Health (*Cellule Technique d'Appui aux Mutuelles de Santé*) and *mutuelle* schemes in the two pilot districts. The project involved mutuelle managers and mutuelle committees (volunteers elected by the community to promote the *mutuelle* agenda) at the sub-district level, and CHWs to promote and distribute *Sûr'Eau* to *mutuelle* member households at the community level. Expectations were that sales of *Sûr'Eau* directly to *mutuelle* members at the village level would offset one potential barrier of consistent use: accessibility of the product. Bringing the product out to communities could be key to increasing consistent use, by reducing the cost of transport and time lost in traveling to the nearest health center.

In December 2007 and January 2008, about 3,200 people were trained to conduct pilot activities in Nyagatare and Rubavu, covering more than 1,100 villages and a population of about 600,000. The training covered the technical aspects of household water treatment, management of *Sûr'Eau* stocks, and distribution and sales at the community level.

The pilot was officially launched in Nyagatare in February 2008 and in Rubavu in June 2008.[1] Through the pilot, *Sûr'Eau* was sold to *mutuelle* members in Rubavu at the on-going price of RWF 300, while in Nyagatare sales were at a discounted price of RWF 200. The sales price in Nyagatare was subsidized by the POUZN project, for the purposes of comparing uptake and use of the product at a regular and a lower price. A promotional free bottle of *Sûr'Eau* was offered to each *mutuelle* household in the initial stage of the pilot.

Sûr'Eau was distributed to participating *mutuelle* sections by PSI/Rwanda at the wholesale price of RWF 200 in Rubavu and a subsidized (by the project) price of RWF 150 in Nyagatare. Therefore, a profit margin of RWF 50 per bottle sold remained at the *mutuelle* in Nyagatare, and RWF 100 profit per bottle remained in Rubavu. In Nyagatare, RWF 30 of this profit margin is kept by the CHWs selling the product, and the remaining Rw 20 remains at the *mutuelle* section. In Rubavu, RWF 50 of the margin remained for the CHWs and RWF 50 for the *mutuelle* section. *Mutuelle* sections used their profit to help cover pilot-related operational and management costs.

Central components of the pilot were small group outreach sessions conducted by CHWs and *mutuelle* staff. These sessions provided education on safe water and sanitation, and were used to promote and sell *Sûr'Eau* at the community level. Messages included in the outreach sessions were consistent with the information heard through radio, mobile cinema, and at health centers. CHWs were trained to coordinate their outreach and promotional activities in order to reach each community in their area at least once a month, to ensure consistent supply of *Sûr'Eau* and to monitor correct use in households.

An integral part of the pilot project was a formal impact evaluation to measure the effect of the intervention on knowledge and use of the product in the targeted communities, prevalence of diarrhea among children under five, and out-of-pocket expenditures for diarrhea treatment.

METHODOLOGY OF PILOT EVALUATION

The evaluation of the pilot had two components:

(1) impact evaluation based on household survey and health facility data

(2) interviews with stakeholders

The impact evaluation assessed the effect of the pilot on use of *Sûr'Eau* – including ever use, current use, and consistent use - as well as proximal determinants of use such as knowledge of the product and its purpose and correct use. In addition, the study measured changes in prevalence of diarrhea and related out-of-pocket expenditures on treatment for children less than 5 years from *mutuelle* member households; and changes in the number of outpatient visits for diarrhea treatment at public health facilities.

The impact evaluation used a difference-in-differences design, which includes comparison of a pre-intervention (baseline) and a post-intervention (endline) measurement of key indicators in the pilot sites

[1] The launch of the project in Rubavu was delayed due to problems with product supply from the factory. Some re-training activities were therefore conducted in Rubavu shortly before the launch

and a control site, the district of Karongi where the pilot was not implemented at that time. Difference between change (in a given indicator) in the pilot site and change in the control site indicates the impact of the pilot.

Data for the impact evaluation was collected through a household survey of mutuelle member households with children under 5 (primary target group of the pilot) in the three study districts. Baseline data were collected from 2,378 households in December 2007, shortly before launch of the pilot; endline data were collected from 2,402 households in August 2009. Data on outpatient visits at health facilities were collected from the Health Management Information System of the MOH.

We interviewed a range of stakeholders involved in implementing the pilot, including staff at the MOH Technical Unit for *Mutuelles*, CTAMS (*Cellule Technique d'Appui aux Mutuelles de Santé*), PSI/Rwanda, as well as district health directors, district-level and sector-level *mutuelle* managers, and community health workers in the two pilot districts. In total, 18 people involved in the pilot project were interviewed. The interviews sought information on the experience and perception of stakeholders with regards to pilot implementation, including benefits from the pilot and implementation challenges.

FINDINGS

General water treatment practices

The person in charge of water for the household was asked whether he/she did anything to treat their drinking water, and if so what was the method used most often. In each of the three study districts, boiling was the most-frequent type of household water treatment reported both at baseline and endline. In the two pilot districts, there was a significant decrease in the proportion of households who said they did not treat their water at all, and a move from boiling to using *Sûr'Eau*. In Nyagatare, the proportion of households not treating their water decreased from 23 to 14 percent, and in Rubavu this decrease was from 44 to 25 percent. In the control district, the proportion of households who said they did not treat their water increased from 38 to 47 percent, and nearly all who said they treated their water reported boiling as the main method.

About 60 percent of those reporting some form of household water treatment said they practiced the method every time they collected water. However, we had no way to verify this and it is likely that these results reflect only general self-reported practices, rather than what household do consistently with regards to safe water treatment.

Use of *Sûr'Eau*

Use of *Sûr'Eau* increased substantially in the two intervention districts between baseline and endline, and remained unchanged in the control district. The estimated impact of the pilot is measured by an adjusted difference-of-differences measure from multivariate regression models that control for differences among districts in socio-economic and other variables.

The results for the different indicators on use of *Sûr'Eau* are as follows:

- *Ever use:* the pilot was associated with a 40 to 42 percentage point increase in ever use. At endline, the proportion of households reporting ever use of *Sûr'Eau* reached 59-61 percent in the pilot districts, but remained at 11-12 percent in the control district.

- *Consistent self-reported use*[2]: the pilot was associated with a 20 to 23 percentage point increase in consistent self-reported use, which reached 21-22 percent in the pilot districts and remained at 1-2 percent in the control district.

- *Current self-reported use*[3]: the pilot was associated with 8 to 9 percentage point increase in; it reached 8-9 percent in the pilot districts and remained at 1 percent in the control district.

- *Current verified use (by chlorine residual)*[4]: the pilot is associated with a 3 to 4 percentage point increase in this indicator; it reached 3 to 6 percent in the pilot districts, and remained at 1 percent in the control district.

Results are largely similar in the two pilot districts (i.e. differences in effect are very small and none are statistically significant).

At endline, the most frequent source of *Sûr'Eau* in the pilot districts were CHWs, from whom about two-thirds of ever-users purchased *Sûr'Eau*. In the control district, half of users purchased it from retail outlets and pharmacies with only 14 percent purchasing from CHWs.

Respondents who had heard of *Sûr'Eau* but never used it were asked about the reasons why they never tried the product. In each district, the most frequently cited reason at baseline was not knowing where to buy the product, mentioned by about a third of non-users. At endline, financial constraint (no money/too expensive) was the reason most often given in Nyagatare and Karongi, whereas the proportion of non-users who said they did not know where they could buy the product had dropped significantly. In Rubavu, main reason for non-use remained not knowing where the product was available, followed by financial reasons.

Knowledge of *Sûr'Eau*

At baseline, knowledge of Sûr'Eau and its purpose was high in all three study districts. In the pilot districts, there was a substantial increase in the proportion of households who had heard of *Sûr'Eau* (reaching 97 percent) and those who had correct knowledge of its purpose,[5] whereas there was no change in these indicators in the control district. At endline, knowledge of the correct use of *Sûr'Eau* was significantly better in the pilot districts, compared to the control district.

Exposure to messages[6] on Sûr'Eau in the six months preceding the endline survey was significantly higher in the pilot districts (71 to 88 percent of households), than in the control district (42 percent). Inter-personal communication (IPC) was a key element of the pilot project, with CHWs trained and instructed to promote water treatment and Sûr'Eau directly to households, including home visits. This element of the pilot intervention reached about half of households in the pilot districts, compared to only 6 percent in Karongi. Exposure to general messages on safe water, hygiene, and sanitation in the pilot districts was also higher than in the control district.

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[2] Consistent use is defined as stated use "every time we collect water". Further analyses of the data showed that this indicator is not reliable, and consistent use is likely to be over-reported.
[3] Current use is defined as self-report of using Sûr'Eau to treat the household's current stored drinking water.
[4] This indicator is defined as self-report of Sûr'Eau use on the day of interview or previous day and presence of free chlorine residual of at least 0.2 mg/liter.
[5] Correct knowledge of the purpose of Sûr'Eau is defined as respondent's statement that Sûr'Eau is used "to kill germs" or "to make water safe to drink".
[6] In this report, "exposure to messages/IPC" is defined as self-reported hearing or seeing of messages/IPC by respondent. The recall period for each type of "exposure" is specified in the text, along with the results.

The proportion of households who heard *Sûr'Eau* messages at a community meeting was significantly higher in the pilot districts (24 percent in Nyagatare and 55 percent in Rubavu), compared to the control district (7 percent). Similarly, households in the pilot districts had more exposure to *Sûr'Eau* messages at health facilities, compared to those in the control district. Most importantly, while four out of ten households in the pilot districts reported that a community resource person (typically a CHW) has spoken with them personally about *Sûr'Eau* in the past six months, this was the case for only 3 percent of households in the control district.

These results reflect the messaging activities implemented by the pilot: *mutuelle* managers that we interviewed mentioned giving "health talks" on safe water and *Sûr'Eau* to patients waiting to be seen at health centers (aiming to reach mothers with young children); and community gatherings were often mentioned as venues where *mutuelle* managers and CHWs gave talks on safe water and promoted use of *Sûr'Eau*.

Effect of messages and IPC on use of *Sûr'Eau*

We used multivariate regression analysis of the endline data to investigate the effect of different messaging channels on the various indicators of use of Sûr'Eau. The results indicate a strong effect of IPC, but do not show consistent or large effect of messages specific to *Sûr'Eau* or safe water received from any channel. Exposure to IPC on Sûr'Eau in the past six months is associated with a 17 percentage-point increase in ever use, 6 percentage point increase in current self-reported use, and a 4 percentage point increase in verified current use.

Additionally, we looked at the effect on use of the most-frequently cited sources on messages related to Sûr'Eau: radio, health facility, community meeting, and brochure/poster. Among these four sources, community meetings appear to be the most effective channel for increasing use of *Sûr'Eau*, followed by health facilities. Exposure to messages on *Sûr'Eau* at a community meeting is associated with a 14 percentage point increase in the probability of using *Sûr'Eau* at some point (ever use), 8 percentage point increase in self-reported current use, and 4 percentage point increase in verified (by chlorine residual) current use. Similarly, exposure to message(s) on *Sûr'Eau* at a health facility is associated with a 14 percentage point increase in the probability of ever use, and a 5 percentage point increase in current self-reported use.

Hearing message(s) on *Sûr'Eau* on the radio was not found to have a significant effect on ever use or current use. Seeing message(s) on a brochure/poster in the past six months is associated with a 20 percentage point increase in probability of ever use of *Sûr'Eau*, but was not found to have a significant effect on current use.

Prevalence of diarrhea

While prevalence of diarrhea is an important outcome targeted by the pilot, our study had a limited ability to measure this outcome as there are many district-specific factors (besides the pilot project) that could influence diarrhea, and because the baseline and endline surveys were not conducted in the same month of the year (though both were during a dry season). Moreover, due to data limitations at the *mutuelle* level (specifically, *mutuelles* did not keep records of members' diagnoses), it was not possible to assess quantitatively whether there was a decrease in diarrhea outpatient visits among *mutuelle* members during the time of pilot implementation; and whether *mutuelle* expenditures for diarrhea treatment were lower because of the pilot.

The household survey results – which are subjects to the limitations described above - do not indicate that the pilot was associated with significant reduction in prevalence of diarrhea among children under

five. Data from health facility and *mutuelle* records provide some indication that implementation of the pilot may have had a protective effect against diarrhea: while the number of outpatient diarrhea cases treated in health facilities increased in both the pilot and control districts, the increase was much smaller in the pilot district. At the same time, *mutuelle* membership – an important determinant of outpatient care seeking – increased at similar rates in the pilot and control districts.

Findings from stakeholder interviews

Overall, implementers and stakeholders involved with the pilot both at central level and in Nyagatare and Rubavu were very enthusiastic about the success of the pilot in reducing diarrhea (particularly cholera cases) and substantially reducing the associated expenditures of the mutuelles (since diarrhea is among the leading causes of illness in these areas). Accordingly, there was a strong desire by these stakeholders to continue the activity in the pilot areas, and recommendation to expand it to other districts. However, respondents based their opinions about the success of the pilot on personal observations and anecdotal evidence, rather than data that could prove that the observed reduction in diarrhea cases and overall *mutuelle* expenditures is clearly attributable to the pilot.

The cost of training and launch activities, as well as supply of *Sûr'Eau* directly to *mutuelle* sections were covered by the project. In the first year of pilot implementation, the operational costs for pilot implementation were thought to include: time, transport, and other costs incurred by mutuelle sections managers and CHWs to conduct promotion and sales of *Sûr'Eau*, and to maintain records of sales. The *mutuelle* managers we interviewed did not consider the time they spent on pilot-related activities to be substantive additional burden on their workload: some used their visits to communities for usual *mutuelle* business (such as promotion of enrollment) to also promote *Sûr'Eau* and check on the CHWs selling it; and all viewed the additional record-keeping on *Sûr'Eau* sales to be relatively minor, as part of their general record-keeping for the *mutuelle*. Opinions varied on whether CHWs received adequate compensation for their pilot-related time and transport costs. We were only able to conduct one group discussion with four CHWs in Rubavu and they thought that the profit they made on *Sûr'Eau* sales was too low compared to their costs.

The model to promote and sell *Sûr' Eau* through the *mutuelle* sections in collaboration with the community health workers was viewed as a good model for this type of intervention. The reasons highlighted by stakeholders included:

- CHWs are best positioned to promote safe water practices and sell *Sûr' Eau*, as they are close to the community (they are elected and trusted by community), and already tasked with disease prevention.

- *Mutuelle* section managers have a strong incentive to implement this intervention, as spending on diarrhea treatment is a problem for the financial sustainability of *mutuelle* sections.

- *Mutuelle* committees are well-positioned to promote safe water interventions, as they already do health-related community mobilization (promote *mutuelle* membership).

Most respondents mentioned that selling the product was difficult at the beginning but picked up over time. The main barriers to use pointed out by respondents were lack of sensitization on safe water and objections to the strong chlorine smell of treated water. In general, those we interviewed in both districts thought that the price at which they were selling *Sûr'Eau* was not an issue for most households in their areas.

The main recommendation that emerged from the stakeholder interviews was to involve from the beginning the local leaders (including village heads and administrative committees at the village and cell level), inviting them to participate in the initial training sessions. It was pointed out that local leaders play an important role in setting example and convincing communities to adopt practices such as water treatment.

CONCLUSIONS

The pilot project succeeded in substantially increasing knowledge and use of Sur Eau within a relatively short period of implementation. The community-based focus of the pilot appears to be the main driver of this success. It is essential that expansion of the pilot considers the lessons learned about implementation, and improves upon the community-level activities that were part of the pilot. Data were not available to assess whether the *mutuelles* experienced a reduction in expenditures for diarrhea treatment. The *mutuelle* managers interviewed for the evaluation believed this was the case and were supportive of the role of the *mutuelles* in the pilot and looked forward to its continuation and expansion.

1. BACKGROUND

1.1 CONCEPT OF THE PROJECT

Mutual health organizations (MHOs), also known as community-based health insurance schemes, have been growing at a rapid pace in many developing countries since the 1990s. MHOs focus on informal sector, low-income populations and are a promising channel for reaching these target groups with preventive health messages and products. MHOs work directly at the community level offering opportunities for community-based communication and distribution. One of the most prominent problems facing MHOs is their financial sustainability. Therefore, they are always looking for innovative ways to reduce costs without negatively affecting the benefit packages offered to members. Increasing the use of proven preventive health products and behaviors by MHO members may be one way for MHOs to reduce costs, as a result of decreased morbidity of members. Accordingly, investing in the promotion and distribution of a health product to members can be a promising cost-reduction strategy for MHOs. However, MHOs have rarely been tapped for the promotion and distribution/sale of preventive health products.

In early 2007, two global projects sponsored by the United States Agency for International Development (USAID), Health Systems 20/20 and Social Marketing Plus for Diarrhea Disease Control: Point-of-Use Water Disinfection and Zinc Treatment (POUZN), initiated discussions on designing a pilot project to distribute a water disinfection product that was already being promoted and marketed by POUZN, through MHOs. The objective of the pilot project was to answer the following questions:

- Can MHOs increase use of child health products among their members?
- Does this result in lower child morbidity?
- Are there cost savings to MHOs from reduced morbidity?
- Is the intervention cost-effective for MHOs?

Answers to these questions have implications for the feasibility of scaling up and replicating the pilot project to reach other low-income communities with child health products through MHOs.

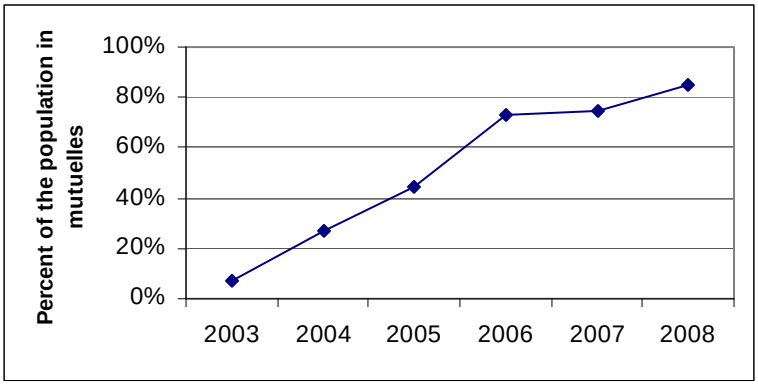
1.2 PROJECT LOCATION

MHOs have become an important part of the national health financing strategy in a number of countries in sub-Saharan Africa. In Rwanda, where MHOs are known as *mutuelles* de santé, 75 percent of the population is covered by about 400 *mutuelles* organized around public and mission health centers throughout the country. Rwanda is one of the poorest countries in sub-Saharan Africa, with 60 percent of its 9.7 million population living below the official poverty line (NISR 2007). The country has one of the world's highest child mortality rates: one in ten Rwandan children does not live to his or her fifth birthday (MOH 2009). The high MHO coverage and poor child health situation in Rwanda made this country a suitable choice for this pilot project. Health Systems 20/20 and POUZN projects partnered with Population Services International (PSI) to design and implement the pilot project in Rwanda.

1.3 *MUTUELLES* IN RWANDA

The development of *mutuelles* in Rwanda was a targeted strategy of the government to overcome the worrisome decline in primary health care services utilization after the re-introduction of user fees in 1997. In 1999, the Ministry of Health (MOH), with technical support from the USAID-sponsored Partnerships for Health Reform Project, initiated pilot *mutuelle* schemes in the three largest health districts of the country. Since then, *mutuelles* in Rwanda have experienced significant growth, reaching 85 percent national enrollment rate in 2008 (MOH/CTAMS 2009) (Figure 1).

FIGURE 1: ENROLLMENT IN *MUTUELLES* IN RWANDA, 2003-2008



Source: MOH/CTAMS

Administratively, Rwanda is divided into four provinces and Kigali city, which spread over 30 districts. Each district is divided into sectors, and sectors are further divided into cells. An administrative cell comprises several sub-cells (villages or neighborhoods, known as umudugudu, each including about 100 households). A health center typically covers one sector.

The *mutuelle* enrollment unit is the household and the premium is RWF 1,000 ($1.76) per person per year. The benefit package includes all preventive and curative services, prenatal care, delivery care, and laboratory exams provided at the primary health care level, as well as drugs on the MOH essential drug list and ambulance transport to the district hospital. Members make a co-payment of RWF 200 ($0.35) for each visit at the health center level.

The current organizational system of *mutuelles* is built around three levels. The lowest level is the *mutuelle* section, which operates around a defined health center catchment area. The *mutuelle* sections are managed by a board that includes a chairman, a secretary, a treasurer, and an auditor (who are volunteers elected by a general assembly of *mutuelle* members) and supported by permanent salaried staff – a *mutuelle* manager and supporting staff - dealing with the daily business of the scheme. At the community level, the *mutuelle* sections are represented by a *mutuelle* committee that includes three to four volunteers. The *mutuelle* committees are responsible for mobilizing the community to join the *mutuelles*, identifying indigent families to be supported by the schemes for membership, and collaborating with village authorities in implementing the *mutuelle* agenda. Many of the *mutuelle* committee members are community health workers (CHWs—also known as *animateurs de santé*). These are volunteers elected by the community and coordinated by health centers.

The second organizational level is the district *mutuelle*, which includes all *mutuelle* sections in a given administrative district. There are currently 30 district *mutuelles* throughout the country and each of them is in charge of contractual relations with the district hospital, hospital reimbursement, and quality-of-care supervision. District *mutuelles* are funded by 10 percent of the premium contributions collected

by the *mutuelle* sections, plus subsidies from the national risk-pooling fund (described below) and from the district. They are managed by a board that includes representatives from the *mutuelle* sections and other organizations in the district, though daily management of district *mutuelle* operations is conducted by a permanent staff paid by the district. Access to district hospital care for *mutuelle* members requires an authorized referral from the health center level. Members are entitled to a comprehensive package of services provided at this level, and pay 10 percent of the total hospital bill.

The third organizational level for *mutuelles* in Rwanda is the Health Scheme Technical Support Unit (*Cellule Technique d'Appui aux Mutuelles de Santé*, or CTAMS), which is set up at the central level to provide technical assistance to all *mutuelles* in the country. CTAMS is also in charge of the National Risk Pooling Fund set up by the government to provide (1) a complementary benefit package for secondary and tertiary health care to *mutuelle* members, and (2) subsidies for enrollment of indigents in the *mutuelle*. The CTAMS, through the National Risk Pooling Fund, makes annual block transfers to the district *mutuelles* for hospital care coverage of their members. Tertiary care at the national referral hospitals is paid for directly by the National Risk Pooling Fund. Access to tertiary hospital care requires an authorized referral from a district hospital. Members pay 10 percent of the total hospital bill. Funding of CTAMS and the National Risk Pooling Fund comes primarily from the government, with subsidies from external donors such as the Global Fund for AIDS, Tuberculosis, and Malaria. The Global Fund, along with other NGOs, have opted to finance health insurance premiums for the poorest Rwandans, orphans and people living with HIV/AIDS.[7]

Mutuelles in Rwanda have increased members' access to health services and there is general satisfaction of beneficiaries with the services available through their *mutuelle* membership (Schneider et al. 2001; Diop and Butera 2004). Development of the *mutuelles* over time has been undertaken in close collaboration with health providers and with the support of two key ministries: the MOH and the Ministry of Local Government. *Mutuelles* in Rwanda now play an important role in the health system. In addition, the high enrollment rate and the proximity of *mutuelle* structures to communities makes *mutuelles* a high-potential channel for community-based activities such as promotion of health education and preventive activities. Such activities can reduce curative care costs for *mutuelles* in Rwanda, and contribute to their financial sustainability. Preventive activities and products with potential to be promoted through *mutuelles* include proven low-cost interventions such as use of oral rehydration salts (ORS) and zinc to treat diarrhea, POU water treatment products, insecticide-treated nets, childhood immunization, and behavior change to improve hygiene, nutrition, and other health-related practices.

1.4 DIARRHEAL DISEASE IN RWANDA

Diarrheal disease is the leading cause[8] of child death in Rwanda, accounting for an estimated 24 percent of child deaths (WHO/UNICEF 2010). The 2005 Demographic and Health Survey (DHS) found that 14.1 percent of children under five had diarrhea in the two weeks preceding the survey (NISR 2006). Two years later, the Interim DHS 2007-2008 found that this prevalence had remained unchanged, at 13.7 percent (MOH 2009). Unsafe water and poor hygiene and sanitation are major contributors to diarrhea prevalence. While there is overwhelming evidence that POU water treatment reduces diarrhea prevalence (Fewtrell et al. 2005, Arnold and Colford 2007, Clasen et al. 2007), use of POU treatment by households in Rwanda is very low. Based on these factors, the USAID funded POUZN and Health Systems 20/20 Projects and participating district mutuelles in Rwanda initiated a pilot project to

[7] The targeting process of beneficiaries for different government or donor supported programmes is led by the communities who identify the most vulnerable among them (a traditional approach called Ubudehe).
[8] Excluding neonatal causes.

integrate the provision of a POU water treatment product with targeted promotional and outreach activities through the *mutuelles*.

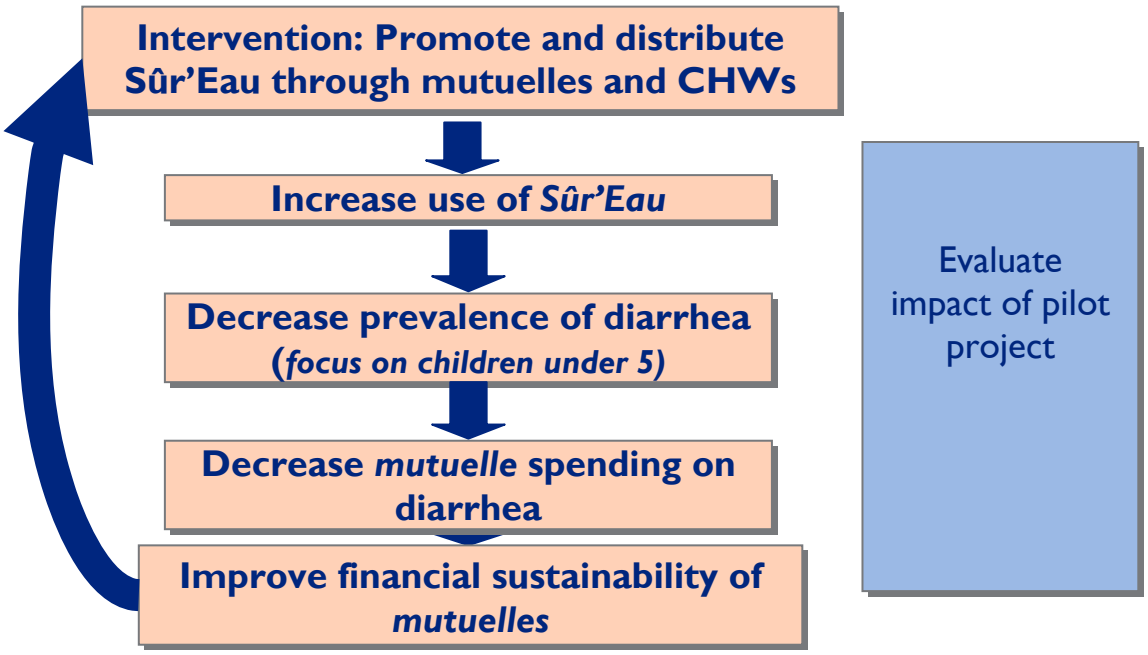
2. PROJECT IMPLEMENTATION

2.1 OVERVIEW

Sûr'Eau ("safe water"), a chlorine-based point-of-use (POU) water disinfection product, has been available in Rwanda since 2002, when it was introduced by PSI/Rwanda through a social marketing program. In the following years, there were periodic stock-outs and irregular distribution of the product, and overall use of *Sûr'Eau* was very low, particularly in rural areas. In 2007, PSI revived the social marketing of *Sûr'Eau* with funding through the POUZN Project, and sales of *Sûr'Eau* resumed, focusing on distribution through both health centers and commercial outlets throughout the country. PSI works through wholesale distributors to supply commercial outlets, while it supplies *Sûr'Eau* directly to health centers. One bottle of *Sûr'Eau* is sold at RFr 300 ($0.55) at both commercial retail outlets and the public sector, and can treat the drinking water of a family of four to five members for five to six weeks.

The key pilot implementing partners were Population Services International (PSI), HS 20/20, CTAMS and CBHI schemes in the two pilot districts. The pilot project aimed to increase use of *Sûr'Eau* primarily among poor rural communities. The main intervention of the project was the promotion and distribution of *Sûr'Eau* at the community level through the *mutuelle* sections and via CHWs (who are often members of the *mutuelle* committees). Increased use of the product was expected to lead to decreased prevalence of diarrhea, and lower costs for diarrhea treatment for the *mutuelles*. This, in turn, would provide further incentive for *mutuelles* to institutionalize the intervention and consider including similar distribution of other health promotion products for their members. The conceptual framework of the pilot project is illustrated in Figure 2.

FIGURE 2. CONCEPTUAL FRAMEWORK OF THE PILOT PROJECT



An integral part of the pilot project was a formal impact evaluation to measure the effect of the intervention on knowledge and use of the product in the targeted communities, prevalence of diarrhea (particularly among children under five), and out-of-pocket expenditures for diarrhea treatment.

The pilot was implemented in two districts, Nyagatare and Rubavu, where *Sûr'Eau* was promoted and sold to *mutuelle* members by CHWs. *Mutuelle* members in Nyagatare were able to buy *Sûr'Eau* at a discounted price (33 percent off the regular price) from the CHWs, while *mutuelle* members in Rubavu paid full price. For the purposes of the impact evaluation, a control district, Karongi, was included in the study. In all three districts, *Sûr'Eau* continued to be available for sale through health centers and commercial outlets at the price of RWF 300 (Table 1).

TABLE 1: STUDY DISTRICTS

	Pilot Districts		**Control District**
	Nyagatare	**Rubavu**	**Karongi**
Intervention	*Sûr'Eau* promoted and sold at discounted price to *mutuelle* members by CHWs and *mutuelle* staff	*Sûr'Eau* promoted and sold at full price* to *mutuelle* members by CHWs and *mutuelle* staff	*Sûr'Eau* available for sale at full price* through health centers and commercial outlets
Price of *Sûr'Eau* to *mutuelle* members through the pilot	RWF 200 ($0.35)	RWF 300 ($0.55)	RWF 300 ($0.55)
Price of *Sûr'Eau* to all through retail & health centers	RWF 300 ($0.55)	RWF 300 ($0.55)	RWF 300 ($0.55)

* Full-price is the price that product is being sold at other outlets (public and private) but it does not cover the full cost of manufacturing the product.

2.2 STUDY SITES

The three study districts were chosen by the project partners, Health Systems 20/20 and PSI/Rwanda, in collaboration with the MOH and the *mutuelles* advisory board based on the following criteria:

- *Disease prevalence*: The pilot districts, Nyagatare and Rubavu, were chosen due to their very high prevalence of diarrheal disease in past years. Both districts suffered cholera outbreaks in the past year, and continually have the highest burden of diarrheal disease in the country. Impact of the pilot project was expected to be greater in such settings, and hence easier to measure.

- *High coverage of the population by mutuelles*: In Nyagatare, 82 percent of the population were enrolled in *mutuelles* in 2007, while in Rubavu coverage was 51 percent. In the control district of Karongi, *mutuelle* coverage was 68 percent.

- *Strong support systems*: All three districts have strong *mutuelle* systems and local government support for both the *mutuelles* and this project. Strong support for *mutuelles* and the project are considered essential to successful implementation.

- *Geographical location*: Nyagatare is located in the northeast, while Rubavu is located in the northwest of the country. Implementing the pilot in two different regions of the country was to assure some geographical representativeness of the pilot. The control district, Karongi, is located in the west. Like Rubavu, it borders Lake Kivu.

All three districts are predominantly rural, and similar in population size (about 300,000 people). While Nyagatare and Karongi have a similar number of *mutuelles* (18 and 17 *mutuelles*, respectively), Rubavu has significantly fewer *mutuelles* (only eight). This difference is due to the fact that Rubavu is smaller in territory and more densely populated than the other two districts, and thus has fewer health centers (which are the units around which *mutuelles* are established). Table 2 summarizes the district characteristics.

TABLE 2: STUDY DISTRICTS

	Pilot Districts		Control District
	Nyagatare	**Rubavu**	**Karongi**
Population	280,000	300,000	280,000
Location	Northeast	Northwest	West
Area (square km)	1,741	600	993
Number of mutuelles	18	8	17
Mutuelle coverage			
2007	82%	51%	68%
2009	84%	78%	97%

Nyagatare District

The District of Nyagatare is one of the seven districts that constitute the Eastern Province of Rwanda. The district is divided into 14 sectors, which are further divided into 106 cells and 630 villages. Nyagatare spreads over an area of 1,741 km^2 with 280,000 inhabitants. There are 18 health centers and an equal number of mutuelles in the district. Mutuelle coverage was 82 percent in 2007 and 84 percent in 2009.

The hydrographic network in Nyagatare is very limited. There are only three main rivers: Muvumba, which cuts across the district, and the Akagera and Umuyanja rivers, which constitutute the district and country borders with Tanzania and Uganda respectively. There are no other consistent water sources such as a river that can be exploited by the population in Nyagatare – the few other rivers in the district are erratic and intermittent. The weak river network limits the availability of reliable water supply for households and there were frequent reports of cholera outbreaks in the district at the time of pilot planning: in the first quarter of 2007, about 1,000 cases of cholera were registered. Cholera outbreaks typically occur during the dry season. The last cholera outbreak in Nyagatare was in October 2008.

Rubavu District

Rubavu is one of the seven districts constituting the Western Province of Rwanda. The district covers an area of about 600 km^2 and is home to over 300,000 inhabitants. Rubavu is divided into 12 administrative sectors, 80 cells, and 469 villages. There are eight health centers, with some covering more than one administrative sector. Eight mutuelles have been established alongside each health center. Mutuelle coverage in 2007 was 51 percent, and increased to 78 percent in 2009.

Many households in Rubavu draw water from Lake Kivu. The water is not potable and there are frequent cholera outbreaks. Cholera outbreaks typically occur duringthe dry season, when many water sources dry out and households have less water available for use and need to switch to sources that are less safe. The last cholera epidemic in Rubavu occurred in September 2008.

Karongi District

Karongi district is in the West Province and is situated on the shores of Lake Kivu. The district is divided into 14 sectors, 88 cells, and 539 villages. Karongi spreads over an area of 993 km^2 with 280,000 inhabitants. The district has 17 health centers, and an equal number of mutuelles. Mutuelle coverage was 68 percent in 2007, increasing to 97 percent in 2009. As in Rubavu, many households take their drinking water from Lake Kivu.

2.3 PROJECT IMPLEMENTATION

Preparation and training activities

The preparatory phase of the project started in April 2007, with consultations between HS20/20, POUZN and the MOH (represented by CTAMS) on the choice of the pilot districts and the design of the intervention. The project design was presented to stakeholders in the two intervention districts, Nyagatare and Rubavu. These stakeholders included representatives from each mutuelle section, health centers, and district authorities. A baseline study (pre-intervention data collection) was conducted in December 2007.

In December 2007-January 2008, Health Systems 20/20 and PSI/Rwanda, in collaboration with the MOH, conducted a training at two levels: (1) training of trainers for managers at the mutuelle section level, and (2) training of CHWs and mutuelle committee members. The training of trainers included two representatives from the management board of each mutuelle section, the director (or a representative) of the health center corresponding to the mutuelle, and the coordinator of the community health workers. In total, 140 trainers received a six-day training that focused on the technical aspects of household water treatment and on management of product stocks/storage, inventories, vouchers, and distribution/sales. A follow-on workshop was conducted with 50 mutuelle section managers focusing on information and messages for use, and following-up on pilot activities at the village level.

Since mutuelles in Rwanda have a mutuelle committee in each village, the promotion and selling of Sûr'Eau was decentralized down to the village level. Expectations were that sales of Sûr'Eau directly to mutuelle members at the village level would offset one potential barrier to consistent use: accessibility of the product. Bringing the product out to communities could be key to increasing consistent use, thus reducing the cost of transport and time lost in traveling to the nearest health center.

About 2,900 CHWs and mutuelle committee members in Nyagatare and Rubavu were trained to conduct small group outreach sessions and household-level sales of Sûr'Eau in their communities. One CHW typically is assigned to about 50 households, so the number of CHWs per village varies. The project trained two CHWs per village, and, since the typical village has about 100 households, most villages had all of their CHWs trained by the pilot.[9]

Promotion and sales of Sûr'Eau by the project

The official launch of the project in Nyagatare district was in February 2008 at Rukomo health center. The launch of the project in Rubavu was delayed until June 2008, due to problems with product supply from the factory. Some re-training activities were therefore conducted by the project in Rubavu shortly before the launch. Participants in the launch ceremonies included representatives from MOH/CTAMS, PSI, Health Systems 20/20, and the District Health Directors, Vice Mayors for Social Affairs, Mutuelle District Health Directors, and CHWs.

[9] According to a government regulations introduced after the pilot started, the number of CHWs per village was doubled, to about 4 per village currently.

A promotional free bottle of Sûr'Eau was offered to families in Nyagatare and Rubavu who had signed up for the 2008 mutuelle membership. The free promotional supplies were purchased by the project and distributed to all mutuelle sections by PSI. In total, mutuelle sections in Nyagatare received free bottles for about 50 percent of member households, and those in Rubavu received bottles for about 30 percent (the amount of the promotional/free supplies was based on estimated demand). At the launch in Nyagatare, mutuelle members who had their membership cards with them received a free bottle of Sûr'Eau. Further distribution of the free bottles to households in both pilot districts was conducted by the CHWs at the community level in the initial period after launch of the pilot. About 35,500 free bottles of Sûr'Eau were provided to mutuelle members.

All mutuelle sections participating in the pilot also received free "seed stock" of Sûr'Eau. These supplies were also funded by the project and distributed by PSI directly to the mutuelle sections. Sales of the seed stock were meant to generate revenue that would be used by the mutuelle sections to re-purchase stocks from PSI once they ran out of the seed stock. Each section received seed stock of 24 to 48 bottles (one or two boxes) of Sûr'Eau per village, depending on village size. PSI re-supplied most sections in Nyagatare monthly. Most sections in Rubavu had low sales and those that ran out of the seed stock were re-supplied by PSI upon request for additional bottles.

In addition, PSI carried out regular promotional activities to support the Sûr'Eau initiative, and provided ongoing assistance with the general project management at the community, mutuelle, health center, and district levels. PSI staff visited all mutuelle sections in each district bi-monthly. During these visits, PSI provided technical assistance to mutuelle managers in stock management, reporting and follow-up of sales activities in villages.

After the initial free seed stock, Sûr'Eau was sold to participating mutuelles by PSI/Rwanda at the wholesale price of RWF 200 in Rubavu and a subsidized (by the project) price of RWF 150 in Nyagatare. The subsidy in Nyagatare was meant to ensure that an adequate margin on sales remains at the mutuelle. Therefore, a profit margin of RWF 50 per bottle sold remained at the mutuelle in Nyagatare (where mutuelles sold the product for RWF 200), and RWF 100 profit per bottle remained in Rubavu (where the sales price was RWF 300).

In Nyagatare, RWF 30 of this profit margin was kept by the CHWs selling the product, and the remaining Rw 20 remained at the mutuelle section, where it was kept in a separate "Sûr'Eau account". The section used these funds to help cover management costs (e.g. stamps, stationery, and transport costs for pilot-related reporting).

In Rubavu, mutuelle management decided to give RWF 50 of this margin to the CHWs selling the product, and to keep the remaining RWF 50 at the mutuelle section to help cover pilot-related operational and management costs.

In both districts, the CHWs kept the margin they earned on Sûr'Eau sales for themselves, rather than depositing it in the joint CHW accounts that are typically used for sales of other health products that they sell at the village level.

Central components of the pilot were small group outreach sessions conducted by CHWs and mutuelle staff. These inter-personal communication (IPC) sessions provided education on safe water and sanitation, and were used to promote and sell Sûr'Eau at the community level. Messages included in the outreach sessions were consistent with the information heard through radio, mobile cinema, and at

health centers. In addition, rapid product demonstrations were held in the pilot districts.[10] CHWs coordinated their outreach and promotional activities in order to reach each community in their area at least once a month, to ensure consistent supply of Sûr'Eau and to monitor correct use in households. CHWs received Sûr'Eau-branded t-shirts and promotional materials.

Five rapid product demonstrations were conducted in the two pilot districts at the beginning of the pilot, reaching 1,600 participants in Nyagatare and 1,100 in Rubavu. According to PSI's records, in 2008 IPC sessions reached 552 persons in Nyagatare, 226 in Rubavu and 37 in Karongi. PSI reports that in the first three quarters of 2009, IPC sessions reached 5,250 mutuelle members in Nyagatare and Rubavu.

Promotion of Sûr'Eau by nationwide social marketing campaign

On a regular basis apart from this project, PSI conducts advertising and promotion of *Sûr Eau* throughout the country through mobile cinema, drama performances, billboards, radio, point-of-sale materials (flip charts, stickers, brochures, T-shirts), as well as through interpersonal communication (IPC) and peer education including outreach activities at the community level by NGOs, and health education talks at health centers. Consumer brochures are placed in private sector points of sale and health centers, and metal signs have been installed at water stations. Community health workers, community-based organizations and NGO partners help distribute the brochures, stickers, banners, and posters. At health centers, there are weekly health talks to waiting patients, and active promotion to patients who come for diarrhea. During outbreaks of diarrheal disease (typically cholera) PSI delivers *Sûr'Eau* directly to the affected areas (upon request from MOH or district authorities), and these emergency supplies are then distributed free to households by the CHWs. These nationwide activities related to PSI's *Sûr'Eau* program continued in the three study districts over the duration of the pilot project.

The mass media campaign at the time when the pilot was implemented included radio broadcasts on the four national radio stations, with radio spots running until August 2008. Several mobile cinema sessions were conducted in Nyagatare and Rubavu in 2008 and 2009, reaching about 5% of the population in each district.

Educational sessions on safe water were held with school children in 25 schools in Nyagatare, 25 schools in Rubavu and 21 schools in Karongi. Additionally, 33 FOSA sessions were held in Nyagatare and 17 were held in Rubavu.

[10] The rapid product demonstration is designed to draw large crowds and quickly teach them the benefits and attributes of the product, to increase product awareness.

3. EVALUATION DESIGN

3.1 OVERVIEW

The evaluation of the pilot looked at the impact of the pilot intervention on use of *Sûr'Eau* – including ever use, current use, and consistent use - as well as proximal determinants of use such as knowledge of the product and knowledge of its purpose and correct use. In addition, we measured prevalence of diarrhea and related out-of-pocket expenditures on treatment for children under 5 years of age from *mutuelle* member households.

The evaluation used a difference-in-differences (DID) study methodology. This design included a pre-intervention (baseline) and a post-intervention (endline) measurement of key indicators influenced by the pilot.

For the purposes of the study, Nyagatare and Rubavu are *intervention* districts, while Karongi is a *control* district. To measure the impact of the pilot (intervention) on a given indicator (e.g. use of *Sûr'Eau*), we compare the change in the indicator from baseline to endline in the intervention group to the change in the control group. This DID measure indicates the effect of the pilot on the given indicator. Table 3 illustrates this method. The groups in this case are random samples of *mutuelle* member households with children under five (primary target population of the pilot) from the intervention and control areas.

TABLE 3. MEASURING THE EFFECT OF THE PILOT USING A DIFFERENCE-IN-DIFFERENCES METHODOLOGY

Group	Use of Sûr'Eau at BASELINE	Use of Sûr'Eau at FOLLOW-UP	Difference in use of Sûr'Eau
Pilot (intervention)	a	b	b-a
Control	c	d	d-c
Effect of the pilot = (b-a) – (d-c)			

Comparison of results between the two pilot districts could be indicative of the effect of discounted price on use of the product. However, since it was difficult to ensure that implementation of pilot activities was exactly the same in the two pilot districts, comparison of results likely does not reflect only the effect of the price discount. Importantly, CHWs in the two pilot districts received a different margin on sales, and it is possible that the amount of the margin also had an effect on the sales efforts by CHWs (the district with the discounted price had lower sales margin retained by the CHWs, compared to the district with no price discount). Other factors, such as – for example – level of engagement in and advocacy for the pilot by district and local leaders or health workers, may also be confounding the effect of the price discount on use of *Sûr'Eau*.

Data for the evaluation were collected through:

1. A household survey conducted in each of the three study districts.

2. Data from the HMIS of the MOH and the *mutuelle* sections in the three districts

In addition, we interviewed 18 stakeholders involved in implementing the pilot, including staff at the MOH Technical Unit for *Mutuelles*, CTAMS (*Cellule Technique d'Appui aux Mutuelles de Santé*), PSI/Rwanda, as well as district health directors, district-level and sector-level *mutuelle* managers, and community health workers in the two pilot districts. The interviews sought information on the experience and perception of stakeholders with regards to pilot implementation, including benefits from the pilot and implementation challenges.

3.2 HOUSEHOLD DATA COLLECTION

The household survey covered only mutuelle member households who had at least one child under 5. Membership of the head of the household or the spouse of the head was used as a proxy for household membership.

The survey used a structured questionnaire that was administered to the household head or his/her spouse and the person in charge of the household's drinking water. The questionnaire collected data on the demographic and socio-economic characteristics of the household, *mutuelle* membership, and knowledge and practices related to household water treatment and use of *Sûr'Eau*. In a household where a member was reported to have had diarrhea in the two weeks preceding the survey, that person or a knowledgeable adult (or the caregiver in case of children) was interviewed using a curative care questionnaire. The curative questionnaire collected data on use and expenditures for health care services related to the diarrhea episode. Both questionnaires were translated into Kinyarwanda, and all interviews were conducted in Kinyarwanda. Informed consent to participate in the research was obtained from every individual interviewed for this study.

The baseline household data collection took place in mid-December 2007, shortly before the start of program implementation. The endline data collection was in July-August 2009. The study protocol was reviewed and approved by the Rwanda National Ethics Committee, the National Institute of Statistics of Rwanda, and by the Institutional Review Board of Abt Associates Inc. The data were entered in an electronic dataset using CSPro.

Two-stage systematic random sampling was used to select the sample of households. The sample in each district was selected independently. The primary sampling unit or cluster was the sub-cell (or umudugudu), an administrative division that typically covers a village or part of a village. At the first stage of sampling, a sample of sub-cells was selected with probability proportional to size (where size was measured by the number of households in the sub-cell). The same sub-cells were included in the baseline and endline sample. In the second stage of sampling, households in each of the sub-cells sampled at the first stage were selected. Sampling of households at the sub-cell level was different between baseline and endline due to the substantial increase in the number of households eligible for the survey. At baseline, all households in the sampled sub-cells that were *mutuelle* members and had at least one child under five were included in the sample. At endline, systematic random sampling of *mutuelle* households was conducted, so that the number of households in the endline sample was approximately equal to the baseline sample. The resulting sample size is summarized in Table 4.

TABLE 4. HOUSEHOLD SURVEY SAMPLE SIZE

	Nyagatare	Rubavu	Karongi	Total
Number of sub-cells (clusters)	15 (out of 630)	19 (out of 525)	15 (out of 540)	49 (out of 1,695)
Baseline (2007)				
Mutuelle households with children under 5 yrs	862	825	691	2,378
Children under 5 years in sampled households	1,339	1,259	997	3,595
Endline (2009)				
Mutuelle households with children under 5 yrs	933	654	815	2,402
Children under 5 years in sampled households	1,392	939	1,135	3,466

It is likely that some of the households in the baseline sample were also selected in the endline sample.

3.3 DATA FROM HEALTH FACILITIES AND MUTUELLES

Monthly data on the number of outpatient visits for diarrhea in public sector facilities was collected from the Health Management Information System (HMIS) of the MOH for the period January 2007 to September 2009.

Data on *mutuelle* membership and number of health facility visits that *mutuelle* sections paid for were collected from existing records in all *mutuelle* sections in the three study districts. There were several gaps in the data available from *mutuelle* records that limited the types of analyses we could do. Mutuelles did not keep records of the diagnosis for each patient that they paid for (e.g. diarrhea cases). In 2009, there was a change in recording procedures for claims paid by the *mutuelles*, whereby only the total number of illness episodes, rather than the total number of visits, were recorded (i.e. if a *mutuelle* member made more than one visit for a given illness episode, all visits were recorded as one treatment episode). Starting in 2009, data on the number of individual visits paid for by the mutuelles were no longer available. This change in records limited the time period over which we could do some of the analyses.

In addition, the records from many *mutuelle* sections in Rubavu in 2007 and 2008 were of poor quality (as managers at the time were still not well trained in record keeping) and these data were not used in the analyses.

3.4 ANALYTIC METHODS

Household Survey Data

Sampling weights were assigned to each household and to each member within the household. The weights were equal to the inverse of the probability of selection into the sample, and were used in all analyses. All standard error estimates were adjusted for stratification at the district level and clustering at the sub-cell level.

Data on household assets and housing quality were used to construct a wealth index, employing principal components analysis (Filmer and Pritchett 2001).[11] The index was constructed by using the pooled sample of households across the three districts and both survey rounds. The index scores were then ranked and households were divided into five asset wealth quintiles. For individual-level analyses, each household member was assigned the income quintile of his/her household.

The results presented in this report used the following analytic methods:

1. Baseline-endline bivariate comparisons within each district of key indicators related to the pilot;

2. Crude (unadjusted) difference-in-differences measures of key indicators, comparing each of the pilot districts to the control district, as well as comparing the two pilot districts; and

3. Adjusted difference-in-differences measures using multivariate linear regression analyses to control for potentially confounding socio-demographic variables including sex of the head of household, household wealth, type of water source, education and age of the person in charge of the household's water supply, and time and district-specific effects.[12]

In addition, some indicators that were only measured at endline are reported descriptively and compared across the three study districts. Statistical significance of difference in means between districts or between baseline and endline is measured by t-test for binary outcome and by chi-square test for categorical variables with more than two possible outcomes. All analyses were conducted using Stata v.10.

Data from HMIS and *Mutuelle* Records

We looked at trends in the number of outpatient visits for diarrhea in public facilities in the three study districts, and other relevant data to assess whether there was a decrease that could be associated with implementation of the pilot.

3.5 LIMITATIONS OF THE STUDY

Our study has a number of limitations. The most-important of these is the type of study design that was feasible and affordable in this pilot, a pre-post design with control and intervention districts. The key indicators measured by the study are influenced by a multitude of household-level factors that cannot be easily observed and measured, and many interventions (other than the pilot) that vary by district can also affect these indicators (e.g. hygiene and sanitation initiatives). The design that is best suited for measuring impact of an intervention on individual behavior/outcomes is the randomized controlled trial framework, whereby households or villages in the same area are randomly allocated to an intervention and a control group. A randomized controlled design was not feasible in this pilot because the intervention had to be implemented at the district level to assess its overall effect on the district *mutuelle* in terms of implementation feasibility.

[11] The variables used in the index are: number of sheep and goats owned by the household, number of cows owned, type of toilet, type of floor, type of cooking fuel, people per room, has electricity, and ownership of radio, TV, fridge, phone, bicycle, motorcycle, and car.

[12] We also looked at results from variations of this regression model that included longer and shorter lists of independent variables. Results for the dependent variables presented in this report were not sensitive to such variations of the regression models in any meaningful way.

The pre-post design with control and comparison groups selected at a geographic level as large as the district likely has weaknesses for measuring the true effect of the pilot. Such weaknesses include the extent of comparability of the pilot and control districts, differential implementation of *Sûr'Eau* marketing by PSI in the three districts (as part of the general - non-pilot - social marketing campaign), and respondent bias (whereby survey respondents may over-report use of *Sûr'Eau* if this is perceived as socially-desirable behavior, or an answer that is perceived to please the interviewer). Changes in population characteristics that were not measured could also confound our results.

There were a number of other (mostly government-led) initiatives related to improving water, hygiene, and sanitation (WHS) that occurred in the three study districts at the same time the pilot was implemented. We were not able to assess the degree to which such programs had been implemented differently in the three study districts, but we acknowledge that differences in implementation of such activities across the three study districts might account for some of the differences we see in the key indicators measured by our evaluation. Some of the new WHS-related programs that took place in all three study districts (other than the pilot) are:

- Increased focus on WHS by the government since early 2008, which has resulted into community-based initiatives such as monthly meetings to clean village streets/areas and discuss WHS issues. The concept of "performance contract" (also known as "social contract") was introduced, whereby local authorities sign a commitment letter with the central government, and households sign similar letters with local government, promising to abide by certain WHS practices such as keeping the surroundings of their homes clean and building latrines.

- Health centers typically include hygiene and safe water (including Sûr'Eau) among the topics of the "health talks" given by health workers to waiting patients. Health workers may do home visits to talk about WHS issues, among other topics. With the increased focus on WHS from the government, health centers are thought to have intensified these efforts.

4. RESULTS

4.1 DESCRIPTION OF HOUSEHOLD SAMPLE

Table 5 summarizes key descriptive statistics of the households in the study sample at endline. Detailed tables of the baseline sample characteristics are shown in the baseline study report (Chankova and Butera 2008). In this report we show in detail only the endline sample characteristics, and discuss any notable differences between the baseline and endline samples.

The three study sites are poor rural communities. Most households have mud or dung as house floor material and use wood or straw as cooking fuel. Few households have electricity. Nearly all households use some form of pit latrine, and very few have piped water in their residence. In each district, the predominant occupation for household heads is farming, and about half of household heads have no education.

Comparison across districts shows statistically significant differences for many household assets, but the magnitude of the differences is often not substantial. There are notable differences across districts in percent of households with radio (79 percent in Nyagatare, compared to 56 percent in Rubavu and 51 percent in Karongi), ownership of a bicycle (57 percent in Nygatare, compared to 9 percent in Rubavu and only 2 percent in Karongi), and ownership of a mobile phone (47 percent in Nyagatare, compared to 29 in Rubavu and only 13 percent in Karongi). Although nearly all households use some form of pit latrine, better-quality ventilated improved pit (VIP) latrines are more prevalent in Nyagatare (71 percent of households) and Karongi (61 percent), compared to Rubavu (46 percent).

Households in Rubavu and Karongi are classified by the relative asset wealth index (constructed from the endline dataset) as poorer, compared to those in Nyagatare: 49 percent in Karongi and 46 percent in Rubavu belong to the poorest two quintiles, compared to 23 percent for Nyagatare.

TABLE 5. HOUSEHOLD SAMPLE DESCRIPTION (ENDLINE)

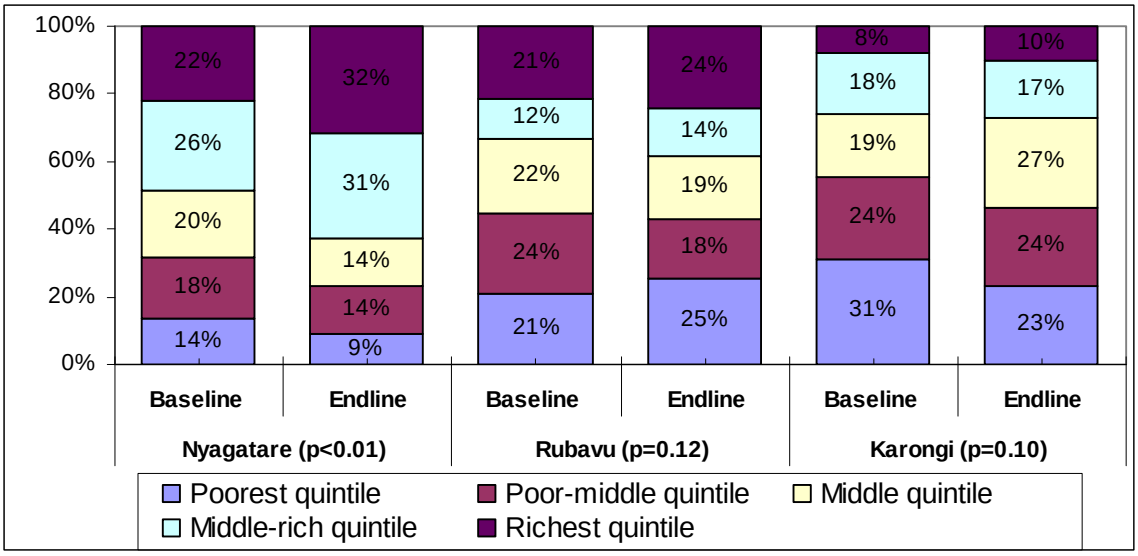
	Nyagatare	Rubavu	Karongi	signif.[1]
Average household size	5.7	5.5	5.2	*
Average number of children under 5 per household	1.5	1.4	1.4	
Female head of household	13%	12%	17%	
Age of household head (% of households)				***
15-24	8%	13%	5%	
25-49	73%	74%	76%	
50 or above	19%	13%	19%	
Education of household head (% of households)				
No education	55%	53%	49%	
Primary	36%	37%	43%	
Post-primary	4%	6%	6%	
Secondary or higher	5%	4%	2%	
Religion of household head (% of households)				***
Catholic	40%	31%	25%	
Protestant	44%	30%	41%	
Adventist	14%	25%	33%	
Other	2%	14%	1%	
Occupation of household head (% of households)				***
Unemployed	2%	6%	3%	
Farmer/shepherd/fisherman	81%	72%	89%	
Civil servant/government employee/military	2%	3%	2%	
Trader/artisan or other	15%	19%	6%	
Ownership of livestock (avg. number)				
Goats	0.59	0.57	0.68	
Sheep	0.06	0.13	0.11	
Cows	1.02	0.39	0.56	**
Asset ownership (% of households)				
Radio	78.6%	55.7%	50.9%	***
TV	3.3%	3.9%	0.6%	
Refrigerator	0.4%	0.4%	0.5%	
Non-mobile phone	0.4%	0.2%	2.5%	***
Bicycle	56.7%	9.3%	1.9%	***
Motorcycle/scooter	5.3%	0.7%	0.4%	***
Car or minitruck	1.4%	1.1%	0.2%	
Mobile phone	47.1%	28.7%	13.3%	***
Have electricity (% of households)	13%	8%	2%	
Main material of house floor (% of households)				*
Earth/mud/dung	82%	84%	93%	
Cement, wood, or other	18%	16%	7%	
Main source of drinking water (% of households)				***
Piped water in residence	3%	3%	1%	
Piped water from public tap	19%	52%	14%	
Public well	40%	27%	62%	
Surface water (river/canal/lake/spring)	29%	12%	21%	
Other	9%	5%	2%	
Primary sanitation facility (% of households)				***
Pit latrine	28%	48%	37%	
VIP latrine	71%	46%	61%	
Other/no latrine	2%	6%	3%	
Primary cooking fuel (% of households)				***
Coal	3%	14%	2%	
Wood/straw	96%	85%	97%	
Relative household wealth (% of households)				***
Poorest quintile	10%	26%	24%	
Poor-middle quintile	13%	20%	25%	
Middle quintile	14%	17%	28%	
Middle-rich quintile	34%	13%	13%	
Richest quintile	28%	23%	10%	

[1] Statistical significiance of difference across districts: *** p<0.01, ** p<0.05, * p<0.1

In each district, there were, overall, no substantial differences between the baseline and endline samples in the key household socio-economic characteristics. Differences between baseline and endline are often statistically significant but in most cases are small.

Education of the head of household was somewhat better at endline than at baseline in Nygatare and Karongi, but slightly worse in Rubavu. The predominant field of occupation in each district remained farming. Relative household wealth was higher in the endline sample than in the baseline sample in Nyagatare, with a larger proportion of households in the richer two quintiles and a lower proportion in the poorest two quintiles, compared to baseline (Figure 3). In Rubavu and Karongi, differences between baseline and endline were small, but also indicating increases in asset wealth.

FIGURE 3 . CHANGE IN RELATIVE HOUSEHOLD WEALTH, MEASURED BY ASSET WEALTH QUINTILE (PERCENT OF HOUSEHOLDS)



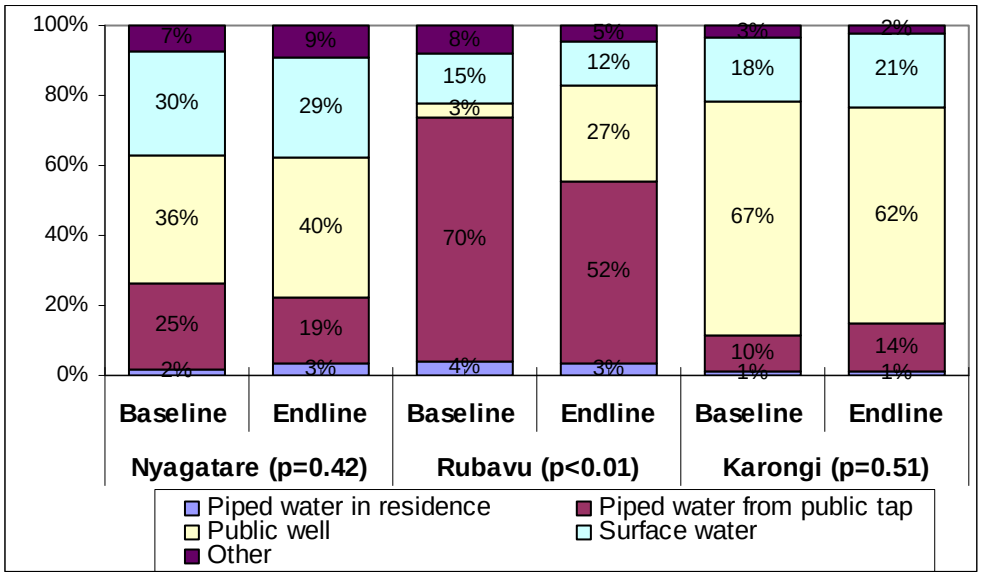
There was no change in the proportion of households using a given type of toilet in Nyagatare, whereas there was an increase in use of VIP latrines in Karongi and a decrease in Rubavu (offset by changes in use of basic pit latrines).

Water Sources

The proportion of households using each type of water source in Nygatare and Karongi was nearly the same at baseline and endline; whereas in Rubavu 27 percent at endline were using a public well, compared to 3 percent at baseline, and the proportion of those using a public tap had decreased from 70 to 52 percent (Figure 4).

There is significant variation in the type of drinking water source used in each district. In Rubavu, 52 percent of households in the endline sample get their drinking water piped from a public tap. In Nyagatare, the two most common sources at endline are a public well (40 percent) and surface water (29 percent), while in Karongi 62 percent of households use a public well as the primary source of drinking water.

FIGURE 4. TYPE OF MAIN WATER SOURCE USED BY HOUSEHOLD (PERCENT OF HOUSEHOLDS)



Person in charge of water

The person in charge of the household's drinking water, along with the head of the household, is typically the decision maker on household water treatment practices. There were no substantial differences across districts at endline in the age or the role of the person in charge of water (Table 6). In the majority of households, this person was the spouse of the head of household. Most had no formal education: 63 percent in Nyagatare, 69 percent in Rubavu, and 52 percent in Karongi. Those in charge of water in the control district of Karongi were overall better educated than in the two pilot districts, Rubavu and Nyagatare.

In nearly all households (95 percent or more in each district), the person in charge of water was the same person as the caregiver for children under five.

As with the head of household characteristics, the proportion of those in charge of water with no education was lower at endline than at baseline in Nyagatare (74 to 63 percent) and Karongi (62 to 52 percent), while the opposite trend was seen in Rubavu (61 to 69 percent).

TABLE 6. CHARACTERISTICS OF THE PERSON IN CHARGE OF HOUSEHOLD'S DRINKING WATER (PERCENT OF HOUSEHOLDS, ENDLINE)

	Nyagatare	Rubavu	Karongi	signif.[1]
Age group (% of households)				***
24 or less	18%	26%	16%	
25-34	43%	45%	48%	
35-49	32%	26%	28%	
50 or above	7%	3%	8%	
Education (% of households)				***
No education	63%	69%	52%	
Primary	32%	26%	45%	
Post-primary	3%	5%	3%	
Secondary or higher	3%	1%	1%	
Role in the household				*
Head of household	11%	10%	14%	
Spouse of household head	81%	85%	77%	
Child/grandchild	6%	4%	8%	
Other	2%	1%	1%	

[1] Statistical significiance of difference across districts: *** p<0.01, ** p<0.05, * p<0.1

By selecting households from the same sub-cells (villages) we aimed to minimize differences between the baseline and endline samples. However, average household characteristics of mutuelle members may have changed due to the substantial increase in mutuelle membership, particularly in Rubavu and Karongi (e.g. it is likely that the households who joined later, between baseline and endline, are different on average from those who were members at baseline – both in observable and unobservable characteristics related to household water treatment). To account for potentially confounding effects on our key indicators by observable socio-economic characteristics, we used multiple regression analysis (described below) to compute adjusted difference-in-differences estimates.

4.2 EXPOSURE TO MESSAGES ON SÛR'EAU

In each surveyed household, the person in charge of the household's drinking water was interviewed. At endline, respondents in each of the two pilot districts reported significantly higher exposure to messages on safe water, hand-washing, hygiene, and sanitation, compared to respondents in the control district: about 90 percent in the pilot districts had received such messages, compared to 70 percent in the control district (Table 7)[13]. It is likely that this difference is largely a result of the overall IEC campaign implemented through the pilot, but it may also be an indication of other district-specific initiatives related to water, hygiene, and sanitation that were more active in the pilot districts.

[13] This information was not collected at baseline.

TABLE 7. PERCENT OF RESPONDENTS WHO HAD HEARD MESSAGES ON WATER, HYGIENE, AND SANITATION IN PAST 6 MONTHS (ENDLINE)

	Safe water	Hand washing	Hygiene	Sanitation
Nyagatare	88%	88%	90%	88%
Rubavu	90%	90%	91%	90%
Karongi (control)	70%	70%	71%	73%

Exposure to messages on Sûr'Eau was also significantly higher in the pilot districts: 88 percent of respondents in Rubavu and 71 percent of respondents in Nyagatare had heard at least one message on Sûr'Eau in the six months preceding the endline survey, compared to 42 percent of respondents in Karongi (Table 8). Inter-personal communication (IPC) was a key element of the pilot project, with CHWs trained and instructed to promote water treatment and Sûr'Eau directly to households, including home visits. This element of the pilot intervention reached about half of the target group in the 6 months before the endline survey: at endline, 51 percent of respondents in Nyagatare and 45 percent in Rubavu said they had received an IPC message on Sûr'Eau in the past six months, compared to only 6 percent in Karongi (Table 8).

TABLE 8. PERCENT OF RESPONDENTS WHO HAD HEARD MESSAGES OR RECEIVED IPC ON SÛR'EAU IN PAST 6 MONTHS (ENDLINE)

	Received IPC on Sur Eau	Heard message on Sur Eau
Nyagatare	51%	71%
Rubavu	45%	88%
Karongi (control)	6%	42%

In the control district, the most common source of messages on Sûr'Eau in the six months preceding the endline survey was the radio, with about a third of respondents citing it as a source (Table 9). A similar proportion in Nyagatare and about half of the respondents in Rubavu cited the radio as a source of Sûr'Eau messages.

The proportion of respondents who heard Sûr'Eau messages at a community meeting was significantly higher in the pilot districts (24 percent in Nyagatare and 55 percent in Rubavu), compared to the control district (7 percent). Similarly, respondents in the pilot districts had more exposure to Sûr'Eau messages at health facilities, compared to those in the control district.

TABLE 9. SOURCE OF MESSAGES ON SÛR'EAU IN PAST 6 MONTHS (ENDLINE, % OF RESPONDENTS)

	Radio	Community meeting	Health facility	Brochure/ poster
Nyagatare	29%	24%	26%	2%
Rubavu	46%	55%	45%	8%
Karongi (control)	31%	7%	11%	1%

These results reflect the messaging activities implemented as part of the pilot: mutuelle managers that we interviewed mentioned giving "health talks" on safe water and Sûr'Eau to patients waiting to be seen at health centers (aiming to reach mothers with young children); and community gatherings were often mentioned as venues where mutuelle managers and CHWs gave talks on safe water and promoted use of Sûr'Eau.

While four out of ten respondents in the pilot districts reported that a community resource person (typically a CHW) had spoken with them personally about Sûr'Eau in the past six months, this was the case for only 3 percent of respondents in the control district (Table 10). Exposure to IPC from neighbors/friends and health facility workers was relatively low in all three districts, but more frequent in the pilot districts compared to the control district.

TABLE 10. SOURCE OF IPC ON SÛR'EAU IN PAST 6 MONTHS (ENDLINE, % OF RESPONDENTS)

	Community resource person	Neighbor/family /friend	Health facility worker	Other
Nyagatare	37%	8%	8%	0.4%
Rubavu	40%	8%	3%	1%
Karongi (control)	3%	3%	1%	1%

4.3 KNOWLEDGE OF SÛR'EAU

At baseline, knowledge of Sûr'Eau was high in all three study districts. In the pilot districts, there was a substantial increase in the proportion of respondents who had heard of Sûr'Eau and nearly all respondents there knew about the product at endline (Table 11). In contrast, there was no change in the control district, where knowledge of Sûr'Eau remained at 77%.

TABLE 11. PERCENT OF RESPONDENTS WHO HAD HEARD OF SÛR'EAU

	Baseline	Endline	Difference (End-Base)	signif.[1]
Nyagatare	86%	97%	0.11	***
Rubavu	65%	96%	0.31	***
Karongi (control)	77%	77%	0.00	

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

At baseline, the majority of respondents who had heard of Sûr'Eau had correct knowledge of what the product is used for. By endline, there was an increase in the proportion of respondents with correct knowledge of the purpose of Sûr'Eau in the pilot district, whereas this proportion did not change in the control district (Table 12).

TABLE 12. PERCENT OF RESPONDENTS WITH CORRECT KNOWLEDGE OF WHAT SÛR'EAU IS USED FOR (% OF RESPONDENTS WHO HAD HEARD OF SÛR'EAU)[1]

	Baseline	Endline	Difference (End-Base)	signif.[2]
Nyagatare	90%	98%	0.08	***
Rubavu	85%	94%	0.09	***
Karongi (control)	91%	92%	0.00	

[1] Correct knowledge means respondent said Sur Eau was used to kill germs or "to make drinking water safe".

[2] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

At endline, knowledge of correct use of Sûr'Eau was significantly better in the pilot districts, compared to the control district. Those who had used Sûr'Eau in the past were asked to describe how they used the product; data collectors used a checklist to record whether respondents mentioned the key steps for using the product correctly. A significantly higher proportion of respondents in the pilot districts mentioned each step, compared to respondents in the control district (Table 13).

TABLE 13. PERCENT OF RESPONDENTS DESCRIBING CORRECTLY THE STEPS OF USING SÛR'EAU (ENDLINE, % OF RESPONDENTS WHO HAD USED SÛR'EAU)

	Nyagatare	Rubavu	Karongi	signif.[1]
	N=559	N=338	N=100	
Fill bottle cap with Sur Eau	37%	37%	9%	***
Pour in 20-liter jerry can	37%	37%	7%	***
Use 2 caps for turbid water	13%	20%	1%	***
Close jerry can and shake well	27%	34%	5%	***
Wait 30 minutes before drinking	33%	35%	7%	***

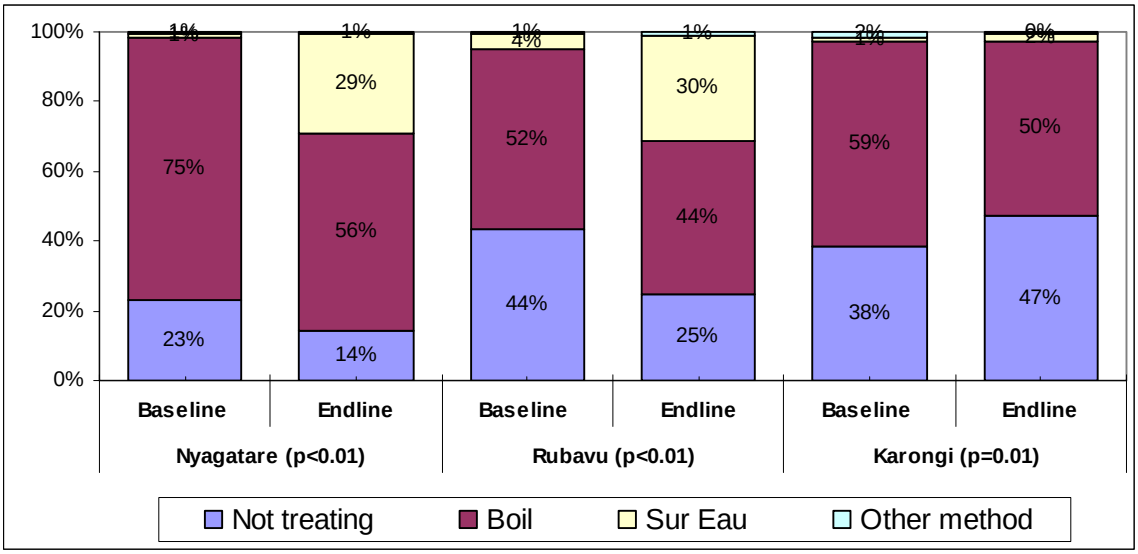
4.4 USE OF SÛR'EAU

General water treatment practices

The person in charge of water for the household was asked whether he/she did anything to treat household drinking water, and if so what was the method used most often. Figure 5 shows the results, but (as will be shown later in this report) these reflect only general self-reported practices, rather than what households do consistently with regards to safe water treatment.

In each of the three study districts, boiling was the most-frequent type of household water treatment reported both at baseline and endline. In the two pilot districts, there was a significant decrease between baseline and endline in the proportion of respondents who said they did not treat their water at all, and a move from boiling to using Sûr'Eau. In Nyagatare, the proportion of respondents not treating their water decreased from 23 to 14 percent, and in Rubavu this decrease was from 44 to 25 percent. In the control district, the proportion of respondents who said they did not treat their water increased from 38 to 47 percent, and nearly all who said they treated their water reported boiling as the main method.

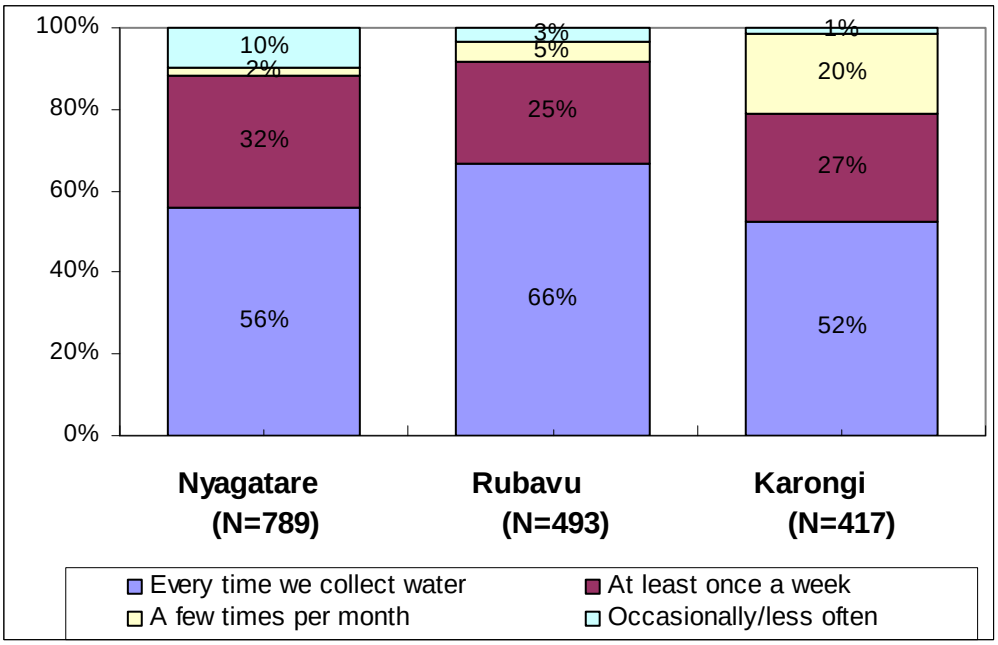
FIGURE 5. HOUSEHOLD TREATMENT PRACTICES FOR DRINKING WATER* (% OF HOUSEHOLDS)



* Self-reported practice. Respondents were asked:
"Do you do anything to treat your water to make it safe to drink?" If yes, "What do you do?"

In the endline survey, respondents who reported treating their drinking water were asked how often they practiced the water treatment method they used most often. About 40 percent reported inconsistent treatment (where *consistent* is defined as response "every time we collect water"), with some variation across districts (Figure 6). It is likely that some proportion of those reporting consistent treatment do not, in fact, treat water every time (based on more detailed data on treatment frequency collected for one of the treatment methods, Sûr'Eau, shown later in this report).

FIGURE 6. FREQUENCY OF GENERAL HOUSEHOLD WATER TREATMENT (ENDLINE, % OF RESPONDENTS REPORTING THEY TREAT WATER)



Ever use of Sûr'Eau

In the two pilot districts, there was a substantial increase in the proportion of respondents reporting that they had used Sûr'Eau at some point, reaching 59 percent in Rubavu and 61 percent in Nyagatare at endline, from a baseline of 18-19 percent (Table 14). In the control district, this indicator remained at 11-12 percent. Results from difference-of-differences estimation models indicate that the impact of the pilot on ever use of Sûr'Eau is a 40 to 42 percentage point increase. The results from analyses of the sub-group of respondents that knew about Sûr'Eau are similar.

TABLE 14. PERCENT OF RESPONDENTS REPORTING THEY HAD EVER USED SÛR'EAU

	Baseline	Endline	Difference (End-Base)	signif.[1]
Nyagatare	19%	61%	0.42	***
Rubavu	18%	59%	0.42	***
Karongi (control)	11%	12%	0.01	

	Difference-in-differences in pilot v. control district			Difference-in-differences between pilot districts		
	Crude	Adjusted	signif.[1]	Crude	Adjusted	signif.[1]
Nyagatare	0.41	0.40	***	0.01	-0.02	
Rubavu	0.41	0.42	***	Ref.	Ref.	
Karongi (control)	Ref.	Ref.		-	-	

[1] Statistical significiance of unadjusted difference: *** p<0.01, ** p<0.05, * p<0.1

Consistent use of Sûr'Eau

Respondents reporting they had used Sûr'Eau were asked about the frequency of use. Self-reported frequency of use increased from baseline to endline in each of the three study districts (Table 15). The increase was significantly larger in the pilot districts, where the proportion of users reporting use every time water was collected reached 42-43 percent at endline (compared to 18% in the control district).

TABLE 15. FREQUENCY OF USE OF SÛR'EAU (PERCENT OF RESPONDENTS REPORTING EVER USE OF SÛR'EAU)

	Nyagatare		Rubavu		Karongi	
	Baseline	Endline	Baseline	Endline	Baseline	Endline
	N=1,793		N=1,478		N=1,504	
	p-value=0.000		*p-value=0.000*		*p-value=0.010*	
Every time we collect water	13%	43%	25%	42%	11%	18%
At least once a week	7%	26%	10%	25%	10%	4%
Occasionally/less often	80%	32%	65%	33%	79%	78%

[1] Self-reported practice. Respondents were asked:"How often do you treat your drinking water with Sur Eau?"

Consistent use of POU water treatment is a key indicator of long-term program success. The design of our study did not allow for measuring objectively consistent use, for example through longitudinal follow-up of households with water tests to verify use. We rely on self-reported consistent use, acknowledging that this measure may be a biased proxy of true consistent use (e.g. some respondents may mis-report consistent use, if they believe that this is a socially-desirable answer).

Table 16 shows the results on consistent use of Sûr'Eau among all households, where consistent use is defined as self-reported use "every time we collect water". Self-reported consistent use increased substantially in the pilot districts, and remained unchanged in the control district. In Nyagatare, a quarter of respondents reported consistent Sûr'Eau use at endline, and in Rubavu a fifth of respondents reported so. By comparison, only 2 percent of respondents in the control district reported consistent use. The DID analysis indicates that the effect of the pilot on self-reported consistent use of Sûr'Eau is a 20 to 23 percentage point increase.

TABLE 16. PERCENT OF RESPONDENTS REPORTING CONSISTENT USE OF SÛR'EAU

	Baseline	Endline	Difference (End-Base)	signif.[2]
Nyagatare	2%	26%	0.24	***
Rubavu	4%	25%	0.21	***
Karongi (control)	1%	2%	0.01	

	Difference-in-differences in pilot v. control district			Difference-in-differences between pilot districts		
	Crude	Adjusted	signif.[2]	Crude	Adjusted	signif.[2]
Nyagatare	0.23	0.23	***	0.03	0.02	
Rubavu	0.20	0.21	***	Ref.	Ref.	
Karongi (control)	Ref.	Ref.		-	-	

[1] Consistent use is defined as self-report of treating drinking water with Sur Eau "every time we collect water"

[2] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

However, the reliability of our results on self-reported consistent use is limited, as further analysis of our data indicates there is over-reporting of consistent use. As Table 17 shows, in the endline survey 59 percent of the respondents who said they used Sûr'Eau every time they collected water, later reported not using it to treat their current drinking water.

TABLE 17. PERCENT OF RESPONDENTS REPORTING CURRENT AND CONSISTENT USE OF SÛR'EAU (ENDLINE)

	Treated current drinking water with Sur Eau (self-report)		
Use Sur Eau "every time we collect water":	**No**	**Yes**	**Total**
No	99%	1%	100%
Yes	59%	41%	100%
Total	*95%*	*5%*	*100%*

This result highlights the importance of longitudinal follow-up study design, including water testing for chlorine residual, to objectively verify consistent as well as long-term use of Sûr'Eau.

Current (time of survey) use of Sûr'Eau

In the two pilot districts, there was a substantial increase in the proportion of respondents reporting they had used Sûr'Eau to treat their current drinking water: from 2 to 11 percent in Nyagatare and from 4 to 12 percent in Rubavu (Table 18). By comparison, current use in the control district remained at 1 percent. DID results indicate that there was a 8-9 percentage point greater increase in current use in the pilot districts than in the control district.

TABLE 18. PERCENT OF RESPONDENTS REPORTING CURRENT USE OF SÛR'EAU

	Baseline	Endline	Difference (End-Base)	signif.[1]
Nyagatare	2%	11%	0.09	***
Rubavu	4%	12%	0.08	***
Karongi (control)	1%	1%	0.0002	

	Difference-in-differences in pilot v. control district			Difference-in-differences between pilot districts		
	Crude	Adjusted	signif.[1]	Crude	Adjusted	signif.[1]
Nyagatare	0.09	0.09	***	0.02	0.01	
Rubavu	0.08	0.09	***	Ref.	Ref.	
Karongi (control)	Ref.	Ref.		-	-	

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

Respondents who reported they used Sûr'Eau to treat their current drinking water were asked about the last time they did so. Both at baseline and endline, the majority said they had treated their water on the day of the interview or the previous day (Table 19).

TABLE 19. LAST USE OF SÛR'EAU FOR TREATMENT OF CURRENT DRINKING WATER (PERCENT OF RESPONDENTS REPORTING CURRENT USE)

	Nyagatare		Rubavu		Karongi	
	Baseline	Endline	Baseline	Endline	Baseline	Endline
	N=108		N=106		N=20	
	p-value=0.477		*p-value=0.439*		*p-value=0.102*	
Today	21%	33%	36%	29%	74%	26%
Yesterday	51%	42%	34%	47%	26%	38%
Two or more days ago	29%	25%	30%	25%	0%	36%

At endline, verification of current use of Sûr'Eau was based on observation of the bottle and a chlorine residual test of stored water in the households reporting use of Sûr'Eau on the day of the interview or the previous day (75 percent of self-reported current users).

Respondents were asked to prepare a cup of water, the way they would usually do for their child to drink. Interviewers then took a 5 ml sample of this water in a test tube and conducted a chlorine-residual test using DPD (N,N diethyl-p-phenylene diamine) tablets and recording the test result as positive if a pink colour was observed (indicating presence of free chlorine residual of at least 0.2

mg/litre, the level that ensures microbiologically clean water according to guidelines by the CDC Safe Water System project).

In nine out of ten households reporting recent use ("today/yesterday") a Sûr'Eau bottle was observed, and in nearly all cases there was still chlorine liquid in it. Similarly, nine out of ten respondents reporting recent use allowed the interviewer to conduct a chlorine residual test of their stored water and provided a sample of water for the test. Of the 127 households identified for chlorine residual testing, three did not allow the interviewer to conduct the test and 10 said that they did not have any stored water at the time of the visit. Chlorine residual was detected in 57 percent of households reporting use of Sûr'Eau on day of the interview or the previous day, and in 70 percent of households reporting use on the day of the interview (Table 20).

TABLE 20. PERCENT OF HOUSEHOLDS REPORTING RECENT USE OF SÛR'EAU WITH CHLORINE RESIDUAL PRESENT IN STORED DRINKING WATER (ENDLINE)

	Reported use "today" or "yesterday"	Reported use "today"
	N=127	N=49
Chlorine residual	57%	70%
No chlorine residual	34%	30%
Refused/no water	9%	0%

A Sûr'Eau bottle with or without liquid in it was observed in nearly all households with chlorine residual (91 percent); and in all households without chlorine residual or where the test was not conducted (Table 21).

TABLE 21. PERCENT OF HOUSEHOLDS WHERE SÛR'EAU BOTTLE WAS OBSERVED, BY CHLORINE RESIDUAL TEST STATUS* (ENDLINE)

	Chlorine residual	No chlorine residual	Refused/no water
	N=72	N=43	N=13
Sur Eau bottle with solution seen	57%	70%	70%
Sur Eau bottle without solution seen	34%	30%	30%
Sur Eau bottle not seen	9%	0%	0%
Total	100%	100%	100%

* Households reporting use of Sûr'Eau today or yesterday for treating their currently stored drinking water.

Although the sample sizes at the district level were small, there was some notable variation across districts in the proportion of recent users with chlorine residual, among those eligible for testing (Table 22). Chlorine residual was detected in the water of the majority of self-reported current users in Rubavu (73 percent) and Karongi (83 percent), while in Nyagatare this proportion was only 38 percent. Possible explanations for this variance include differences in mis-reporting of current use due to different social norms, dosage of Sûr'Eau and turbidity of source water (higher turbidity is associated with higher chlorine demand of treated water, thus leaving less free chlorine residual).

TABLE 22. PERCENT OF HOUSEHOLDS REPORTING RECENT USE OF SÛR'EAU WITH CHLORINE RESIDUAL PRESENT IN STORED DRINKING WATER*, BY DISTRICT (ENDLINE)

	Nyagatare	Rubavu	Karongi	Total Sample
	N=65	N=54	N=8	N=127
Chlorine residual	38%	73%	83%	57%
No chlorine residual	51%	19%	17%	34%
Refused/no water	11%	8%	0%	9%
Total	100%	100%	100%	100%

* Households reporting use of Sûr'Eau today or yesterday for treating their currently stored drinking water.

Table 23 shows the endline results for *verified correct current use of Sûr'Eau*, defining this indicator as self-report of Sûr'Eau use on the day of interview or previous day and presence of free chlorine residual of at least 0.2 mg/liter. Verified correct current use at endline was 3 percent in Nyagatare, 6 percent in Rubavu, and less than 1 percent in the control district. The differences between each of the pilot districts and the control district are statistically significant, as well as the difference between the two pilot districts.

TABLE 23. PERCENT OF HOUSEHOLDS WITH CHLORINE RESIDUAL IN STORED DRINKING WATER AND SELF-REPORTED CURRENT USE OF SÛR'EAU (ENDLINE)

	Estimate	95% Confidence Interval
Nyagatare	3.0%	[1.2% - 4.8%]
Rubavu	5.9%	[3.0% - 8.8%]
Karongi (control)	0.7%	[0.0% - 1.5%]

	Difference in pilot v. control district			Difference between pilot districts		
	Crude	Adjusted	signif.[1]	Crude	Adjusted	signif.[1]
Nyagatare	0.02	0.01	**	-0.03	-0.04	**
Rubavu	0.05	0.06	***	Ref.	Ref.	
Karongi (control)	Ref.	Ref.		-	-	

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

Water testing was not conducted at baseline so baseline values for this indicator are not available. Using self-reported current use of Sûr'Eau at baseline and the extent of discrepancy between self-reported and verified correct current use at endline, the estimated baseline values for this indicator are 0.5 percent in Nyagatare, 2.2 percent in Rubavu and 1.1 percent in Karongi.[14] These figures translate into a DID estimate for the effect of the pilot on verified correct current use of Sûr'Eau of 3 percentage points (Nyagatare compared to Karongi) to 4 percentage points (Rubavu compared to Karongi).

[14] At baseline, 1.5% of households in Nyagatare, 3% in Rubavu and less than 1% in Karongi would have been eligible for chlorine residual test.

Effect of messages and IPC on use of Sûr'Eau

As shown earlier, in the six months preceding the endline survey exposure to messages on safe water and Sûr'Eau was high, particularly in the pilot districts; and about half of respondents in the pilot districts had received a message related to Sûr'Eau through inter-personal communication.[15] We used the endline survey data to investigate the effect of different messaging channels on the various indicators of use of Sûr'Eau.

Table 24 summarizes the results on differences in use of Sûr'Eau (ever use, current self-reported use, and current verified use) between those exposed and not exposed to messages and IPC on safe water and Sûr'Eau. The "adjusted difference" column shows the results from a multivariate linear regression model, which indicate the effect of messages/IPC on use of Sûr'Eau. The unadjusted (crude) differences in use between those exposed and not exposed to messages/IPC are shown for descriptive purposes, and should not be interpreted as measures of the effect on use as they do not account for important confounding factors. The complete regression results are shown in Table A1 in Annex A.

While use of Sûr'Eau was significantly higher among those exposed to messages and IPC on Sûr'Eau and safe water, once we adjust for confounding factors, only one of the messaging interventions – IPC on Sûr'Eau - has a significant effect on all three indicators of use. Exposure to IPC on Sûr'Eau in the past six months is associated with a 17 percentage-point increase in ever use, 6 percentage point increase in current self-reported use, and a 4 percentage point increase in verified current use.

Exposure to messages on Sûr'Eau in past six months (through any channel) is associated with a 7 percentage point increase in ever use, but was not found to have an effect on the current use indicators. Exposure to messages on safe water in past six months (through any channel) is associated with a 2 percentage point increase in current self-reported use, but was not found to have an effect on ever use or current verified use.

[15] In this report, "exposure to messages/IPC" is defined as self-reported hearing or seeing of messages/IPC by respondent. The recall period for each type of "exposure" is specified in the text, along with the results.

TABLE 24. USE OF SÛR'EAU AMONG HOUSEHOLDS EXPOSED AND NOT EXPOSED TO MESSAGES AND IPC ON SÛR'EAU AND SAFE WATER

	Ever used Sur Eau					
	No	**Yes**	**Crude difference**	signif.[1]	**Adjusted difference[2]**	signif.[1]
	row %					
Heard message on Sur Eau in past 6 months	21%	54%	0.33	***	0.07	**
Received IPC on Sur Eau in past 6 months	30%	70%	0.40	***	0.17	***
Heard message on safe water in past 6 months	25%	47%	0.22	***	-0.01	

	Currently using Sur Eau (self-report)					
	No	**Yes**	**Crude difference**	signif.[1]	**Adjusted difference[2]**	signif.[1]
	row %					
Heard message on Sur Eau in past 6 months	2%	11%	0.09	***	0.01	
Received IPC on Sur Eau in past 6 months	4%	15%	0.11	***	0.06	***
Heard message on safe water in past 6 months	2%	9%	0.08	***	0.02	**

	Currently using Sur Eau (self-report & chlorine residual)					
	No	**Yes**	**Crude difference**	signif.[1]	**Adjusted difference[2]**	signif.[1]
	row %					
Heard message on Sur Eau in past 6 months	0%	5%	0.04	***	0.01	
Received IPC on Sur Eau in past 6 months	1%	6%	0.05	***	0.04	***
Heard message on safe water in past 6 months	1%	4%	0.03	***	0.002	

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

[2] Estimated from multivariate regression model, adjusting for: household's socio-economic and district-specific effects, and exposure to IPC and messages on Sur Eau and safe water in past 6 months.

Additionally, we looked at the effect on use of the most-frequently cited sources of messages related to Sûr'Eau: radio, health facility, community meeting, and brochure/poster (Table 25; complete regression results are shown in Table A2 in Annex A). Among these four sources, community meetings appear to be the most effective channel for increasing use of Sûr'Eau, followed by health facilities.

Exposure to messages on Sûr'Eau at a community meeting is associated with a 14 percentage point increase in the probability of using Sûr'Eau at some point (ever use), 8 percentage point increase in self-reported current use, and 4 percentage point increase in verified (by chlorine residual) current use.

Similarly, exposure to message(s) on Sûr'Eau at a health facility is associated with a 14 percentage point increase in the probability of ever use, and a 5 percentage point increase in current self-reported use.

Hearing message(s) on Sûr'Eau on the radio was not found to have a significant effect on ever use or current use. Seeing message(s) on a brochure/poster in the past six months is associated with a 20 percentage point increase in probability of ever use of Sûr'Eau, but was not found to have a significant effect on current use.

TABLE 25. USE OF SÛR'EAU AMONG HOUSEHOLDS EXPOSED AND NOT EXPOSED TO MESSAGES ON SÛR'EAU FROM DIFFERENT SOURCES

	Ever used Sur Eau					
	No	**Yes**	**Crude difference**	signif.[1]	**Adjusted difference[2]**	signif.[1]
Heard/saw message on Sur Eau from:	*row %*					
Radio	40%	47%	0.07	**	<0.01	
At community meeting	34%	66%	0.31	***	0.14	***
At health facility	35%	65%	0.30	***	0.14	***
Poster/brochure	42%	72%	0.30	***	0.20	***

	Currently using Sur Eau (self-report)					
	No	**Yes**	**Crude difference**	signif.[1]	**Adjusted difference[2]**	signif.[1]
Heard/saw message on Sur Eau from:	*row %*					
Radio	7%	10%	0.03	**	0.01	
At community meeting	5%	17%	0.12	***	0.08	***
At health facility	5%	15%	0.09	***	0.05	***
Poster/brochure	8%	7%	0.00		-0.02	

	Currently using Sur Eau (self-report & chlorine residual)					
	No	**Yes**	**Crude difference**	signif.[1]	**Adjusted difference[2]**	signif.[1]
Heard/saw message on Sur Eau from:	*row %*					
Radio	2%	5%	0.03	***	0.02	*
At community meeting	1%	8%	0.06	***	0.04	**
At health facility	2%	6%	0.04	***	0.02	
Poster/brochure	3%	4%	0.01		-0.01	

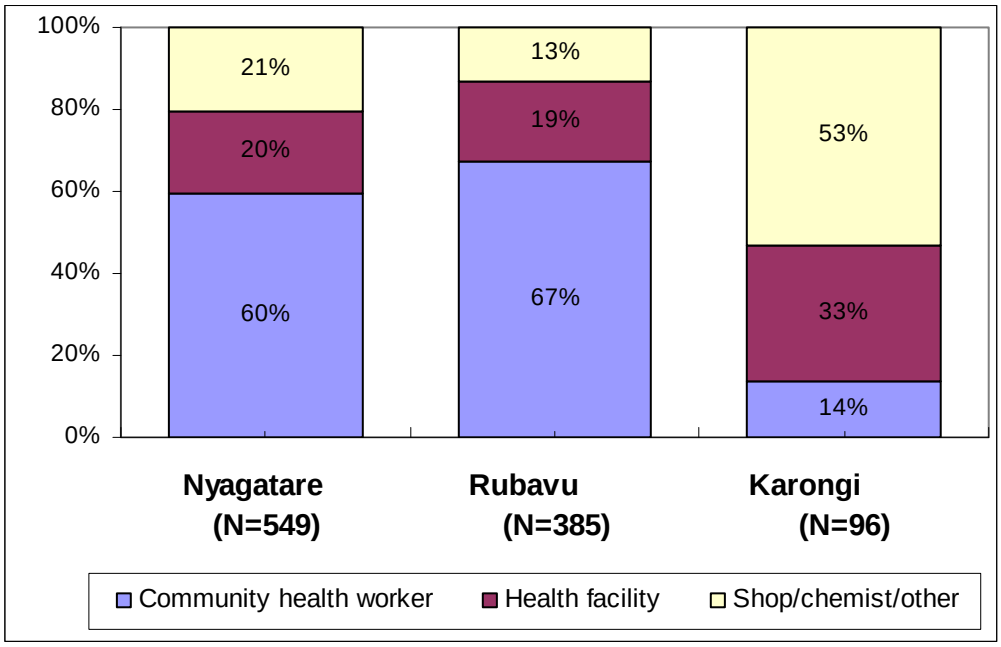
[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

[2] Estimated from multivariate regression model, adjusting for: household's socio-economic and district-specific effects, and exposure to IPC and other sources of messages on Sur Eau and safe water in past 6 months.

Source of Sûr'Eau

At endline, the most frequent source of bottles of Sûr'Eau in the pilot districts were CHWs, from whom about two-thirds of households purchased Sûr'Eau (Figure 7). In the control district, half of users purchased Sûr'Eau from retail outlets and pharmacies, with only 14 percent purchasing from CHWs.

FIGURE 7. USUAL SOURCE OF SÛR'EAU
(PERCENT OF HOUSEHOLDS WHO EVER USED SÛR'EAU)



Reasons for not using Sûr'Eau

Respondents who had heard of Sûr'Eau but never used it were asked about the reasons why they never tried the product. In each district, the most frequently cited reason at baseline was not knowing where to buy the product, mentioned by about a third of non-users (Table 26). At endline, financial constraint (no money/too expensive) was the reason most often given in Nyagatare and Karongi, whereas the proportion of non-users who said they did not know where they could buy the product had dropped significantly. In Rubavu, main reasons for non-use remained not knowing where the product was available and financial reasons. In Nyagatare (where Sûr'Eau was available at a discount), there was no change in the proportion of respondents citing financial reasons for non-purchase. In Rubavu and Karongi, where Sûr'Eau was available at the full price, this proportion increased significantly.

TABLE 26. REASONS FOR NOT TRYING SÛR'EAU
(PERCENT OF HOUSEHOLDS WHO NEVER USED SÛR'EAU)

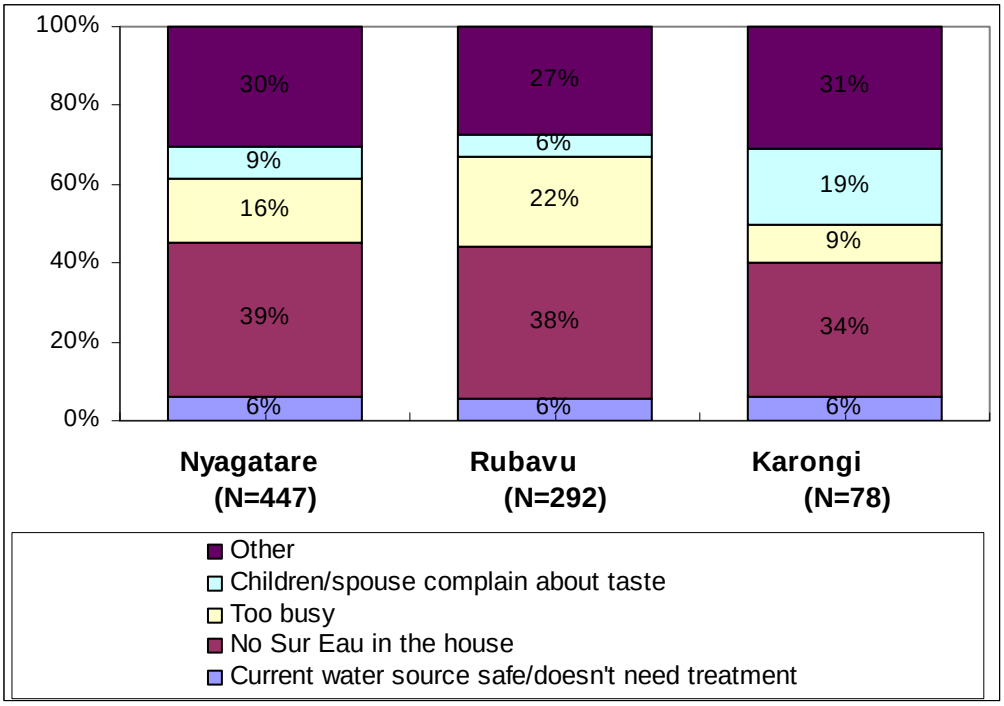
	Nyagatare			Rubavu			Karongi		
	Baseline	**Endline**	signif.[1]	**Baseline**	**Endline**	signif.[1]	**Baseline**	**Endline**	signif.[1]
	N=594	N=349		N=418	N=241		N=463	N=516	
Expensive/no money	23%	26%		17%	26%	*	22%	30%	***
Bad taste/smell	3%	18%	***	3%	9%	**	5%	5%	
Too difficult to use	14%	8%	***	7%	15%	**	14%	8%	**
Don't know where to buy	30%	9%	***	32%	26%		31%	12%	***

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

At endline, respondents who had used Sûr'Eau in the past but were not using it at the time of the survey were asked about the main reason for non-use. About a third cited lack of Sûr'Eau at home at the moment (Figure 8). Being too busy was the reason given by 16 percent in Nyagatare, 22 percent in

Rubavu, and 9 percent in Karongi. A larger proportion in the control district cited dislike of the taste of treated water by family members (19 percent), compared to the pilot district. This may be due to the efforts of CHWs to educate households in the pilot district on use of Sûr'Eau: in stakeholder interviews, it was often mentioned that CHWs advised treating water the night before so that the chlorine smell is diminished by the morning when water can be offered to household members. The list of "other reasons" included not having stored drinking water at the moment, boiling current drinking water, using rain water, lack of money, and not being able to find Sûr'Eau.

FIGURE 8. REASONS FOR NOT USING SÛR'EAU CURRENTLY (PERCENT OF HOUSEHOLDS WHO USED SÛR'EAU IN THE PAST BUT NOT USING NOW, ENDLINE)



4.5 PREVALENCE OF DIARRHEA

Diarrhea prevalence is the key health impact variable for the pilot project. However, while we collected data on prevalence of diarrhea in the past 15 days, a number of important limitations of the evaluation study do not allow us to measure definitively the impact of the pilot on diarrhea rates. Some of these limitations, pertaining to the overall study design, were already listed in an earlier section of this report.

In addition, longitudinal follow-up of households to measure diarrhea incidence at multiple points in time is the method typically used by studies assessing the link between POU product use and diarrhea. Budget constraints did not allow us to make repeated visits to households, and we rely on data from only two points in time (baseline and endline surveys). Comparability of baseline and endline diarrhea measurements in our data is limited by the fact that the two surveys were conducted in different months. Baseline data collection took place in December, during the short dry season, while endline data was collected in August, during the long dry season. It is possible that seasons affect diarrhea rates (e.g. water sources of better quality may dry out during the long dry season, leading households to switch to sources that are less safe).

As a result of these important limitations, the diarrhea-related indicators reported in this section are of a generally descriptive nature, and should not be interpreted as indicative of the impact of the pilot on diarrhea.

Diarrhea among children under 5

At baseline, there were no significant differences in prevalence of diarrhea for children under 5 among the study districts. At endline, survey data showed a slight decrease in Nyagatare, and small increases in Rubavu and Karongi but none of the changes were statistically significant (Table 27). Difference-in-differences estimates were also not significant, including estimates from models that adjusted for socio-demographic characteristics.

TABLE 27. PREVALENCE OF DIARRHEA AMONG CHILDREN UNDER 5 (% OF CHILDREN WITH DIARRHEA IN 15 DAYS PRIOR TO SURVEY)

	Baseline	Endline	Difference (End-Base)	signif.[1]
Nyagatare	6%	5%	-0.01	
Rubavu	6%	8%	0.02	
Karongi (control)	5%	6%	0.01	

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

Our estimates of diarrhea prevalence among children under 5 were substantially lower than the estimates from the DHS survey, although the survey questions were asked exactly the same way. Diarrhea prevalence among children under five in our sample at baseline was 5-6 percent, compared to 14 percent measured by the *Interim DHS 2007-2008* in the provinces where the three study districts are located.[16] There are several possible explanations for the difference between the DHS and our estimates: mutuelle member households may have better preventive health practices and thus lower rates of diarrhea than the general population; data collection may have taken place at different time of the year[17]; there may be important differences in how data collectors were trained to probe for information on diarrhea cases.

Child caregivers were asked whether the recent diarrhea case was very serious, serious, or not serious. Table 28 shows that in Nyagatare and Rubavu there was some decrease in the proportion of cases perceived as serious/very serious, compared to an increase in Karongi. These changes were not statistically significant, possibly due to the small sample sizes.

[16] DHS reports diarrhea prevalence of 14.0 percent in the East province (where Nyagatare is located) and 13.6 percent in the West province (where Rubavu and Karongi are).
[17] The DHS survey took place between Dec. 2007 and April 2008. Our baseline data was collected in December 2007.

TABLE 28. PERCENT OF DIARRHEA CASES AMONG CHILDREN UNDER 5 REPORTED AS SERIOUS/VERY SERIOUS[1]

	Baseline	Endline	Difference (End-Base)	signif.[2]
Nyagatare (N=190)	84%	73%	-0.11	
Rubavu (N=187)	68%	60%	-0.08	
Karongi (N=161)	53%	66%	0.13	

[1] Comparison group is cases reported as "not serious"

[2] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

Diarrhea among children under 2 years

The results for children under 2 (a sub-group with higher susceptibility to diarrhea) are largely similar to the results for children under 5 (Table 29). One notable difference is the significant increase in the control district, where diarrhea prevalence at endline was twice as high as prevalence at baseline (5 percent and 11 percent, respectively).

TABLE 29. PREVALENCE OF DIARRHEA AMONG CHILDREN UNDER 2 (% OF CHILDREN WITH DIARRHEA IN 15 DAYS PRIOR TO SURVEY)

	Baseline	Endline	Difference (End-Base)	signif.[1]
Nyagatare	10%	9%	-0.01	
Rubavu	7%	11%	0.03	
Karongi (control)	5%	11%	0.06	***

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

4.6 EXPENDITURES ON DIARRHEA TREATMENT FOR CHILDREN UNDER 5 YEARS

In each of the study districts, about one in four cases of diarrhea among children under 5 was not treated at all, according to information provided by child caregivers in the endline survey. In Nyagatare and Rubavu, about half of children with diarrhea were taken for treatment to a health facility, compared to about a third of children in Karongi (Table 30).

TABLE 30. PERCENT OF CHILDREN UNDER 5 WITH DIARRHEA TAKEN TO HEALTH FACILITY (% OF CHILDREN WITH DIARRHEA IN 15 DAYS PRIOR TO SURVEY)

	Baseline	Endline	Difference (End-Base)	signif.[1]
Nyagatare (N=190)	48%	58%	11%	*
Rubavu (N=187)	56%	57%	1%	
Karongi (N=161,control)	28%	33%	5%	

[1] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

The most-frequently cited reasons for not seeking formal care for children with diarrhea were that the illness had passed or was treated at home (Table 31). Of the caregivers who applied some form of home treatment, 76% at baseline and 68% at endline reported that diarrhea stopped after this treatment.

TABLE 31. MAIN REASON FOR NOT TAKING CHILD UNDER 5 WITH DIARRHEA TO HEALTH FACILITY (% OF CASES NOT TAKEN TO HEALTH FACILITY)

	Baseline	Endline
	N=127	N=151
Can not afford	21%	12%
Health facility too far away	4%	2%
Illness passed/will go away	25%	31%
Treated at home	29%	29%
Other	21%	27%

Nearly all children under 5 taken to a health facility for treatment of diarrhea received care at public/certified health centers and hospitals; a small number of cases were taken to dispensaries or private providers (Figure 9).

FIGURE 9. TYPE OF HEALTH FACILITY VISITED FOR TREATMENT OF CHILD UNDER 5 WITH DIARRHEA (% OF CASES TAKEN TO HEALTH FACILITY)

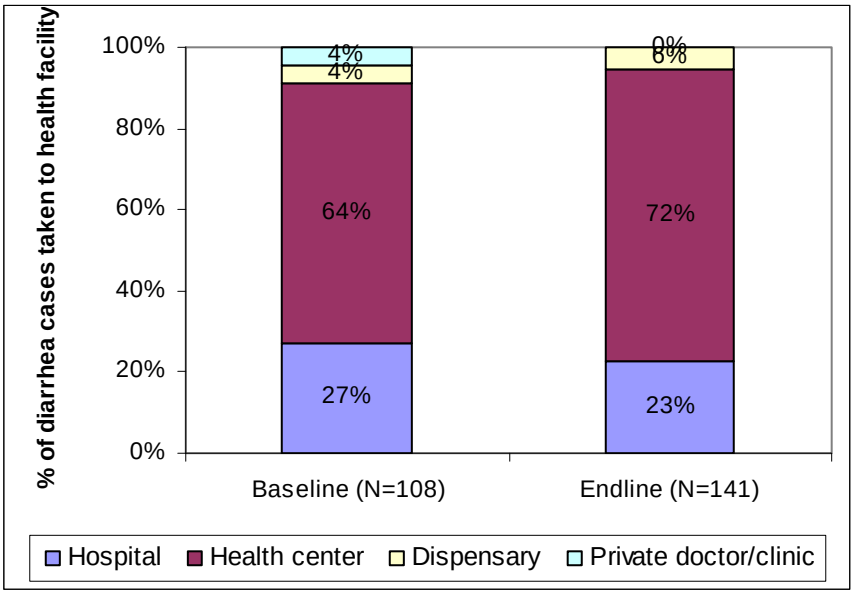


Table 32 shows the average out-of-pocket treatment expenditures incurred by households who had children under 5 with diarrhea in the two weeks prior to the survey. If a child was not taken to a health facility for treatment, expenditures are considered to be zero.

In 2009, the average mutuelle household with children under five in Nyagatare was spending RWF 158 per child diarrhea episode, compared to RWF 118 in Rubavu and RWF 126 in Karongi. These expenditures do not include informal/traditional care or transportation, and are an underestimate of the overall costs incurred by households on treatment of child diarrhea.

Average expenditures on child diarrhea treatment decreased by 35 percent in Nyagatare (RWF 85), and 40 percent (RWF 81) in Rubavu; whereas there was a 40 percent increase in Karongi (not statistically significant). These changes in expenditures between baseline and endline can be a result of changes in many factors related to health care seeking (e.g. access to health facilities, increased motivation to seek and pay for care, etc.) as well as nature of diarrheal disease (e.g. less virulent causes). Therefore, differences in expenditure changes between the districts (as measured from our data) cannot be attributed simply to the pilot.

TABLE 32. OUT-OF-POCKET EXPENDITURES ON DIARRHEA TREATMENT FOR CHILDREN UNDER 5[1] (RWANDAN FRANCS)

	Baseline	Endline	Difference (End-Base)	signif.[2]
Nyagatare (N=190)	243	158	-85	*
Rubavu (N=187)	200	118	-81	*
Karongi (N=161, control)	90	126	36	

[1] Expenditures at endline were adjusted for inflation (28% between 2007 and 2009).

[2] Statistical significiance of difference: *** p<0.01, ** p<0.05, * p<0.1

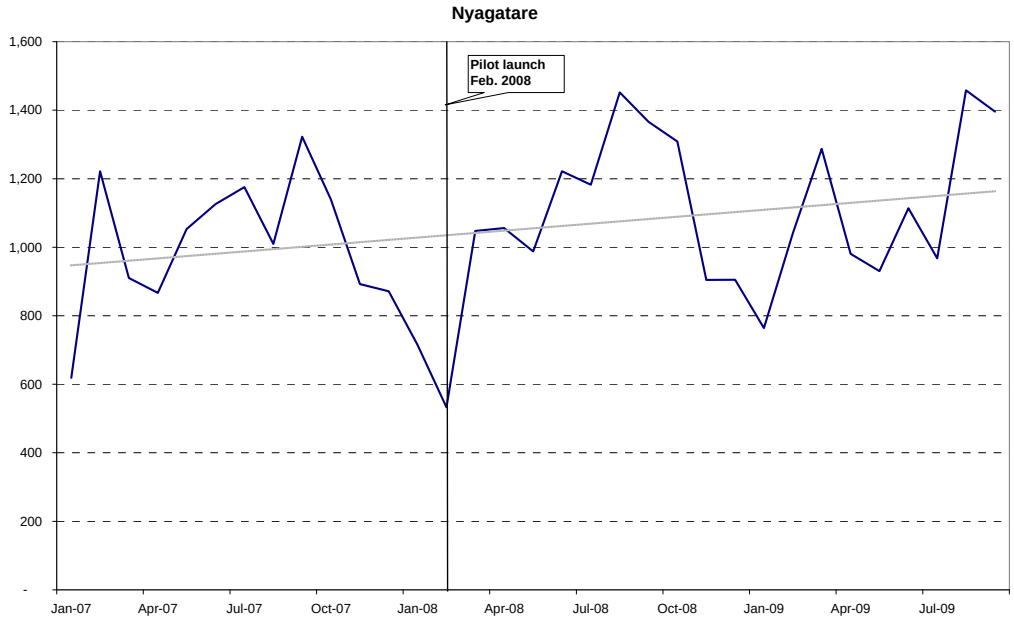
4.7 FINDINGS FROM HMIS AND MUTUELLE RECORDS

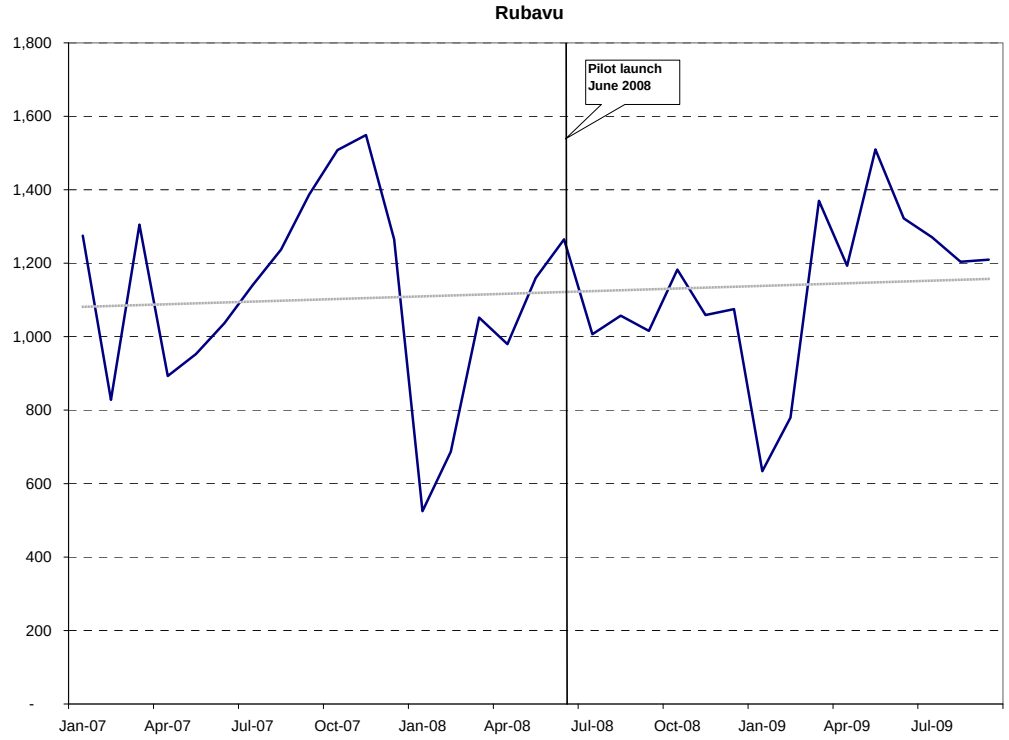
As explained earlier, lack of data and data quality issues limited our ability to assess the extent to which the pilot was associated with reduced payments for diarrhea-related visits by the mutuelles. We used the available data to assess whether implementation of the pilot was associated with a decrease in outpatient diarrhea visits by the population as a whole.

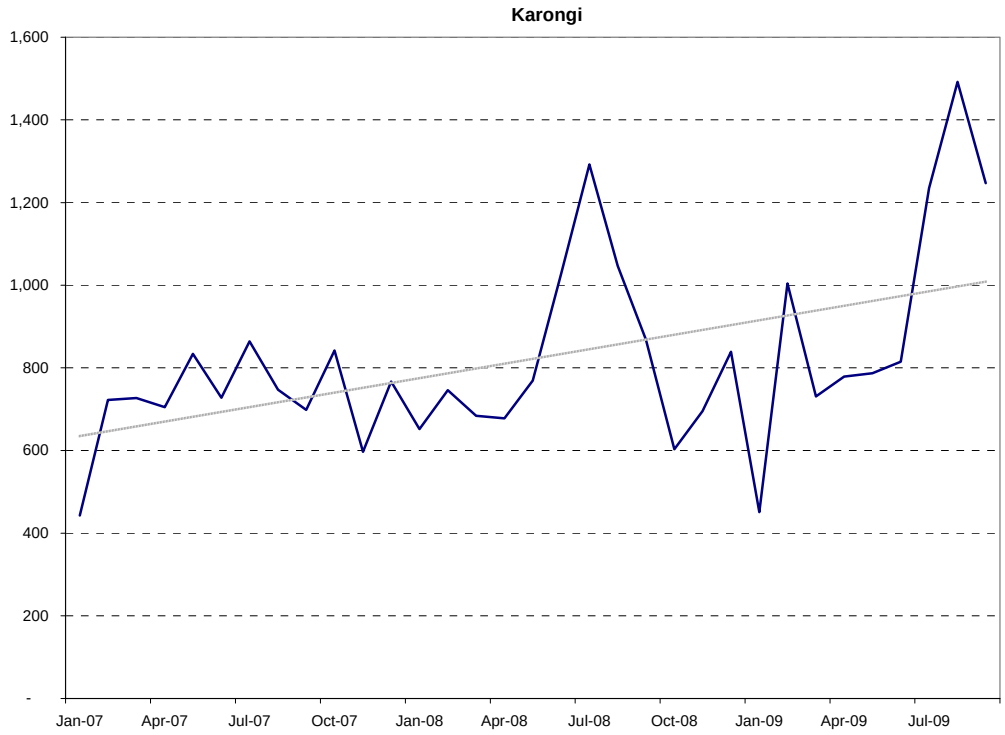
The number of outpatient visits for diarrhea recorded by public health facilities (HMIS data) showed an increasing trend in 2007-2009 in all three districts (Figure 10). This increase could be a result of many factors, including population growth, increase in mutuelle coverage, or improvements in access and quality of care in the public sector. It may also be due to improved record keeping at health facilities.[18] We were able to look into one of these factors – mutuelle coverage (see below).

[18] Several stakeholders interviewed for the evaluation mentioned that the HMIS data may not be of reliable quality.

FIGURE 10. NUMBER OF OUTPATIENT VISITS FOR DIARRHEA IN PUBLIC HEALTH FACILITIES IN NYAGATARE, RUBAVU, AND KARONGI: 2007-2009







The total number of diarrhea visits from January to September[19] increased slightly in Nyagatare in 2008 and 2009, by 3-4% (Table 33). In Rubavu, the increase was 20% from 2007 to 2008 and much smaller (5%) from 2008 to 2009. In Karongi, the increase from 2007 to 2008 was also 20%, compared to 10% in the following year.

TABLE 33. NUMBER OF OUTPATIENT DIARRHEA VISITS IN PUBLIC HEALTH FACILITIES, 2007-2009 (JAN-SEPT)

	2007	2008	*change 2007-2008*	2009	*change 2008-2009*
Nyagatare	9,306	9,561	3%	9,939	4%
Rubavu	8,749	10,494	20%	10,969	5%
Karongi	6,468	7,764	20%	8,541	10%

Increase in mutuelle coverage is one of the main reasons why care seeking at public health facilities may increase each year. Table 34 shows the percent of the population covered by the mutuelles in January-September 2007-2009 in Nyagatare and Karongi (data for Rubavu was of poor quality and not used for these analyses). Coverage was not substantially different in 2007 and increased at similar rates in the two districts in the following two years when the pilot was implemented.

[19] Data for 2009 at time of completion of the study was only available until September. For comparisons across years, only data for January-September is used for each year.

TABLE 34. MUTUELLE COVERAGE, 2007-2009 (JAN-SEPT)

	2007	2008	*change 2007-2008*	2009	*change 2008-2009*
Nyagatare	65%	72%	*11%*	90%	*25%*
Karongi	62%	67%	*9%*	84%	*25%*

The data in the last two tables shows that while mutuelle coverage rates in Nyagatare and Karongi were similar and increased at a similar rate in 2007 and 2008, there was a much larger increase in outpatient diarrhea visits in the control district than in the pilot district during the first and second year of pilot implementation. Since these two districts have the same population size, this finding is similar for the number of diarrhea visits per capita.

A similar result emerges from a comparison of Rubavu and Karongi (Table 33). The increase in diarrhea visits from 2007 to 2008 (reflecting the initial four months of pilot implementation in Rubavu, from June to September 2008) was similar in the two districts. During the second year of pilot implementation, the increase in diarrhea visits in Rubavu (5%) was lower than that in Karongi (10%). However, lack of monthly data on mutuelle coverage does not allow us to investigate whether these changes were accompanied by differential changes in mutuelle coverage in the two districts.

While these results indicate that implementation of the pilot may have had a protective effect for diarrhea, the potential effect of other factors influencing diarrhea prevalence and care seeking prevent us from making a definitive conclusion.

Lack of data makes it impossible to assess quantitatively whether mutuelle members were seeking diarrhea care less frequently during the time of pilot implementation (thus lowering the mutuelle expenditures on diarrhea treatment).

4.8 FINDINGS FROM STAKEHOLDER INTERVIEWS

We interviewed stakeholders involved in implementing the pilot at all levels, including CTAMS, PSI/Rwanda, district health directors, district-level and sector-level mutuelle managers, and CHWs in the two pilot districts. We visited two mutuelle sections in Rubavu and two in Nyagatare. In total, 18 stakeholders involved in the pilot project were interviewed about their experience with pilot implementation, including perceived benefits and costs from the pilot and implementation challenges. We also asked for their recommendations on how the pilot model can be improved.

Perceived benefits of the pilot

Overall, implementers and stakeholders involved with the pilot both at central level and in Nyagatare and Rubavu were very enthusiastic about the success of the pilot in reducing diarrhea (particularly cholera cases) and substantially reducing the associated expenditures of the mutuelles (since diarrhea is among the leading causes of illness in these areas). Accordingly, there was a strong desire by these stakeholders to continue the activity in the pilot areas, and recommendation to expand it to other districts. However, the mutuelle managers and district health directors based their opinions about the success of the pilot on personal observations, anecdotal evidence, and data that does not prove conclusively that the observed reduction in diarrhea cases and overall mutuelle expenditures is clearly attributable to the pilot (as opposed to other factors that may also influence diarrhea prevalence and/or mutuelle expenditures on claims).

The data available at the district health offices and at the mutuelles does not include the number of mutuelle members treated at health facilities for diarrheal disease. While mutuelles have data on the overall number of claims they reimbursed to health providers, there is no data on how many of those claims were for diarrhea treatment. The claim forms received and summarized by mutuelle managers in their registers do not have information on the diagnosis of the patient. Some mutuelle managers said that they can guess, from the type of services and drugs prescribed, whether a claim was for treatment of diarrhea (e.g. if ORS was among prescribed treatments) and this is how they claimed to have noticed a substantial reduction in the diarrhea cases reimbursed after the pilot was implemented.

Perceived costs of the pilot

The cost of training and launch activities, as well as supply of Sûr'Eau directly to mutuelle sections, were covered by the project. In the first year of pilot implementation, the operational costs for pilot implementation were thought to include time, transport, and other costs incurred by mutuelle section managers and CHWs to conduct promotion and sales of Sûr'Eau, and to maintain records of sales.

All four mutuelle section managers found that the pilot was not a substantive additional burden on their workload.[20] Some said they used their visits to communities on routine mutuelle business (such as promotion of mutuelle enrollment) to also promote Sûr'Eau and check on the CHWs selling it, thus saving pilot-specific trips and transportation costs. All mutuelle section managers viewed the additional record-keeping on Sûr'Eau sales to be a relatively minor part of their general record-keeping for the mutuelle, and said they did not mind doing it since it was an intervention that they perceived as important for reducing the mutuelle expenditures for diarrhea claims. There was no perceived time savings from reduced record-keeping on diarrhea claims (even though all claimed there was a decrease in the number of diarrhea claims they processed), possibly because this was part of the work of their assistants, and because the bulk of their work was producing aggregated reports.

CHWs incurred an additional cost for transportation between the mutuelle section office and their village when they had to re-stock Sûr'Eau. Some of the stakeholders interviewed were of the opinion that there was no additional cost involved since CHWs had to visit health centers to pick up their supplies of other health products, such as bednets. However, the four CHWs we interviewed in Rubavu were unanimous that the margin they made on Sûr'Eau sales was too low, given that they had to take time off their regular jobs to pick up Sûr'Eau supplies from the mutuelle section office and cover the transport costs for this.

Opinions on model used by the pilot

The model to promote and sell Sûr' Eau through the mutuelle sections in collaboration with the community health workers was viewed as a good model for this type of intervention. The reasons highlighted by stakeholders included:

- CHWs are best positioned to promote safe water practices and sell Sûr' Eau, as they are close to the community (they are elected and trusted by community), and already tasked with disease prevention.

- Mutuelle section managers have a strong incentive to implement this intervention, as spending on diarrhea treatment is a problem for the financial sustainability of mutuelle sections.

[20] This was in contrast to the opinion of higher-level mutuelle managers who said that the pilot posed substantial additional burden on the workload of section managers, particularly with the increase in mutuelle membership seen recently.

- Mutuelle committees are well-positioned to promote safe water interventions, as they already do health-related community mobilization to promote mutuelle membership.

- Sûr' Eau is inexpensive and easy to use, particularly in comparison with boiling (the other effective safe water treatment practiced in the pilot areas).

Most respondents mentioned that selling the product was difficult at the beginning but they now had many households buying Sûr'Eau regularly. The main barriers to use pointed out by respondents were lack of sensitization on safe water and objections to the strong chlorine smell of treated water.

In general, those we interviewed in both districts thought that the price at which they were selling Sûr'Eau was not an issue for most households in their areas. CHWs in Rubavu said that they had heard a few households complain that the price was too high, and these households would prefer a price closer to RWF 200.

Some mentioned that households with only elderly members used smaller water containers (as they could not carry the 20-liter jerry cans) and therefore could not use the Sûr'Eau bottle cap for correct dosage.

There were anecdotal reports in Nyagatare that some households who were not mutuelle members had asked their mutuelle neighbors/friends to purchase the discounted Sûr'Eau on their behalf. Some respondents thought that the discounted Sûr'Eau in Nyagatare may have been an incentive for some non-member households to join the mutuelles.

Recommendations

When asked about their recommendations on what could be done to make this intervention work better, nearly all stakeholders said that the project should involve, from the beginning, the local leaders (including village heads and administrative committees at the village and cell level). It was pointed out that local leaders play an important role in setting an example and convincing communities to adopt practices such as water treatment. It was suggested that local leaders be sensitized about the importance of Sûr' Eau and invited to participate in the initial training of the mutuelle staff and CHWs, so that they can convey the same message on safe water to their communities.

Other recommendations included:

- Appoint someone at the district level (such as the district mutuelle director) to provide frequent on-site support to pilot implementers at the sector and village level, particularly at the initial stage of the pilot; and provide related funding (e.g for transportation).

- Conduct follow-up training of the mutuelle committees and community health workers, after they have already had some experience promoting and selling Sûr' Eau at their communities. This will allow them to share their initial experiences, discuss the problems they encountered and hear about solutions found by colleagues or recommended by trainers.

- Improve training and supervision on Sûr' Eau stock management and procurement by the mutuelle sections (that are supplied directly by PSI) to address problems with expiring unsold stocks or stock-outs of the product.

- Start with smaller seed stocks and increase supplies to sections according to demand, to avoid expiration of Sûr'Eau supplies in sections with lower initial sales.

- Consider increasing the margin received by those who sell Sûr' Eau at the community level (from current level of RWF 30 in Nyagatare and RWF 50 in Rubavu).

- Continue distribution of Sûr' Eau directly to the section level, as it is not feasible that the district mutuelle office distributes to sections.

- Re-consider the free promotional bottle of Sûr' Eau (given to most mutuelle households at the start of the pilot) – it created expectations that the product is always going to be free..

5. CONCLUSIONS

The pilot project succeeded in substantially increasing knowledge and use of Sur Eau within a relatively short period of implementation. The community-based focus of the pilot appears to be the main driver of this success, particularly the inter-personal communication component carried out by the CHWs with support from the mutuelle structures.

Data were not available to assess whether the mutuelles experienced a reduction in expenditures for diarrhea treatment. The mutuelle managers interviewed for the evaluation believed this was the case. They were supportive of the role of the mutuelles in the pilot and looked forward to its continuation and expansion.

It is essential that expansion of the pilot in Rwanda considers the lessons learned about implementation, and improves upon the community-level activities that were part of the pilot. Further consultation with a larger group of pilot implementers is recommended as an input in the design of an expansion to other districts.

Replication of this pilot in other countries should start with an assessment of the MHO context and the central- as well as local government support both for MHOs and safe water programs. Commitment by local leaders to the pilot agenda is another factor that should be assessed in designing the activity..

ANNEX A. PREDICTORS OF USE OF SÛR'EAU

TABLE A1. PREDICTORS OF USE OF SÛR'EAU: MULTIVARIATE LINEAR MODEL RESULTS, ENDLINE SAMPLE

Variables	Ever used Sur Eau			Currently using Sur Eau (self-report)			Currently using Sur Eau (self-report & chlorine resid.)		
	Coefficient [SE] [a]			Coefficient [SE] [a]			Coefficient [SE] [a]		
	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)
Heard message on Sur Eau in past 6 months	0.070**	0.070**	0.089***	0.017	0.014	0.024*	0.007	0.006	0.011*
	[0.028]	[0.028]	[0.027]	[0.014]	[0.013]	[0.013]	[0.007]	[0.007]	[0.006]
Received IPC message on Sur Eau in past 6 months	0.160***	0.171***	0.191***	0.059***	0.063***	0.072***	0.031**	0.035***	0.038***
	[0.028]	[0.027]	[0.027]	[0.019]	[0.019]	[0.020]	[0.013]	[0.013]	[0.013]
Heard message on safe water in past 6 months	-0.006	-0.006	0.009	0.019**	0.018**	0.026***	0.004	0.002	0.010**
	[0.023]	[0.023]	[0.023]	[0.009]	[0.008]	[0.007]	[0.005]	[0.005]	[0.004]
District (ref: Karongi)									
Nyagatare	0.351***	0.346***	0.379***	0.044***	0.047***	0.055***	-0.004	-0.002	0.001
	[0.055]	[0.056]	[0.062]	[0.015]	[0.016]	[0.018]	[0.009]	[0.008]	[0.009]
Rubavu	0.364***	0.362***	0.352***	0.071***	0.078***	0.059***	0.042***	0.043***	0.031**
	[0.045]	[0.044]	[0.045]	[0.022]	[0.021]	[0.020]	[0.014]	[0.014]	[0.012]
Female household head	-0.010	-0.009		0.005	0.008		-0.003	-0.002	
	[0.027]	[0.027]		[0.014]	[0.014]		[0.012]	[0.011]	
Age of person in charge of water (in years)	-0.001	-0.001		0.000	-0.000		0.000	0.000	
	[0.001]	[0.001]		[0.001]	[0.001]		[0.000]	[0.000]	
Education of person in charge of water (ref: no education)									
Primary	0.038*	0.041*		0.044***	0.036**		0.028***	0.025***	
	[0.022]	[0.021]		[0.016]	[0.015]		[0.010]	[0.008]	
Post-primary	-0.028	-0.021		0.043	0.035		0.040	0.039	
	[0.037]	[0.039]		[0.050]	[0.049]		[0.033]	[0.030]	
Secondary or higher	-0.091	-0.087		-0.064	-0.040		-0.007	-0.018	
	[0.124]	[0.137]		[0.043]	[0.031]		[0.015]	[0.012]	
Household wealth quintile (ref: poorest quintile)									
Poor-middle quintile	0.031	0.027		0.019	0.019		0.001	0.002	
	[0.029]	[0.029]		[0.019]	[0.019]		[0.009]	[0.009]	
Middle quintile	0.041	0.037		0.023	0.023		0.002	0.004	
	[0.028]	[0.028]		[0.017]	[0.016]		[0.011]	[0.010]	
Middle-rich quintile	0.147***	0.149***		0.042**	0.047***		0.017	0.024**	
	[0.031]	[0.033]		[0.018]	[0.016]		[0.013]	[0.012]	
Richest quintile	0.186***	0.178***		0.067**	0.078***		0.033*	0.033**	
	[0.046]	[0.046]		[0.028]	[0.024]		[0.019]	[0.015]	

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Variables	Ever used Sur Eau			Currently using Sur Eau (self-report)			Currently using Sur Eau (self-report & chlorine resid.)		
	Coefficient [SE] [a]			Coefficient [SE] [1]			Coefficient [SE] [1]		
	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)
Occupation of head of household (ref: other)									
Unemployed/retired	-0.065			-0.048*			-0.048***		
	[0.058]			[0.028]			[0.017]		
Farming/agriculture	0.028			-0.012			-0.014		
	[0.045]			[0.028]			[0.019]		
Main drinking water source (ref: rainwater or other)									
Piped in residence	-0.169	-0.204*		-0.065	-0.051		0.016	0.027	
	[0.103]	[0.109]		[0.061]	[0.059]		[0.026]	[0.022]	
Piped in public tap	-0.080	-0.099*		0.009	0.014		0.044**	0.055***	
	[0.050]	[0.058]		[0.051]	[0.050]		[0.016]	[0.015]	
Inside well	-0.199**	-0.225**		-0.047	-0.040		0.008	0.014	
	[0.090]	[0.091]		[0.057]	[0.055]		[0.017]	[0.015]	
Public well	-0.099*	-0.114*		0.010	0.016		0.049***	0.061***	
	[0.056]	[0.064]		[0.049]	[0.048]		[0.017]	[0.015]	
Borehole	-0.168**	-0.181**		-0.006	-0.003		0.052**	0.062***	
	[0.067]	[0.074]		[0.053]	[0.051]		[0.020]	[0.017]	
Surface source (river/canal/lake/spring)	-0.009	-0.023		0.078	0.084		0.066***	0.078***	
	[0.063]	[0.069]		[0.057]	[0.057]		[0.022]	[0.020]	
Constant	0.176**	0.156**	0.067**	-0.029	-0.077	-0.019**	-0.074**	-0.091***	-0.007*
	[0.086]	[0.069]	[0.025]	[0.067]	[0.051]	[0.008]	[0.031]	[0.023]	[0.003]
Observations	**2317**	**2373**	**2389**	**2321**	**2377**	**2393**	**2322**	**2378**	**2394**
R-squared	**0.299**	**0.293**	**0.265**	**0.082**	**0.080**	**0.055**	**0.047**	**0.043**	**0.028**

[a] Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

[b] This model also includes age, education, and religion of the head of household (coefficients not shown)

TABLE A2. PREDICTORS OF USE OF SÛR'EAU: MULTIVARIATE LINEAR MODEL RESULTS, ENDLINE

Variables	Ever used Sur Eau			Currently using Sur Eau (self-report)			Currently using Sur Eau (self-report & chlorine resid.)		
	Coefficient [SE] [a]			Coefficient [SE] [a]			Coefficient [SE] [a]		
	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)
Heard/saw message on Sur Eau in past 6 months from:									
Radio	0.006	0.003	0.026	0.013	0.014	0.022	0.020**	0.019*	0.023**
	[0.026]	[0.026]	[0.026]	[0.019]	[0.020]	[0.019]	[0.010]	[0.011]	[0.010]
At community meeting	0.146***	0.140***	0.150***	0.089***	0.083***	0.089***	0.042**	0.042**	0.046***
	[0.023]	[0.022]	[0.024]	[0.023]	[0.022]	[0.024]	[0.016]	[0.016]	[0.016]
At health facility	0.140***	0.139***	0.152***	0.043***	0.047***	0.055***	0.018	0.020	0.023*
	[0.029]	[0.029]	[0.028]	[0.015]	[0.015]	[0.015]	[0.014]	[0.014]	[0.013]
Poster/brochure	0.189***	0.197***	0.196***	-0.024	-0.024	-0.021	-0.011	-0.010	-0.008
	[0.051]	[0.048]	[0.050]	[0.037]	[0.035]	[0.032]	[0.024]	[0.023]	[0.022]
Received IPC message on Sur Eau in past 6 months	0.130***	0.141***	0.159***	0.042**	0.044**	0.053**	0.022*	0.024*	0.027**
	[0.028]	[0.028]	[0.029]	[0.020]	[0.019]	[0.020]	[0.013]	[0.013]	[0.013]
Heard message on safe water in past 6 months	-0.023	-0.020	-0.007	0.006	0.006	0.012	-0.004	-0.006	-0.000
	[0.022]	[0.022]	[0.022]	[0.010]	[0.009]	[0.009]	[0.006]	[0.006]	[0.006]
District (ref: Karongi)									
Nyagatare	0.345***	0.337***	0.371***	0.040***	0.043***	0.050***	-0.004	-0.002	0.000
	[0.051]	[0.053]	[0.058]	[0.014]	[0.014]	[0.017]	[0.008]	[0.008]	[0.009]
Rubavu	0.280***	0.282***	0.266***	0.029	0.038*	0.019	0.022	0.022	0.010
	[0.042]	[0.042]	[0.042]	[0.022]	[0.022]	[0.021]	[0.016]	[0.015]	[0.013]
Female household head	-0.013	-0.013		0.003	0.005		-0.004	-0.003	
	[0.027]	[0.027]		[0.014]	[0.013]		[0.012]	[0.011]	
Age of person in charge of water (in years)	-0.001	-0.001		0.000	-0.000		0.000	0.000	
	[0.001]	[0.001]		[0.001]	[0.001]		[0.000]	[0.000]	
Education of person in charge of water (ref: no education)									
Primary	0.037*	0.040**		0.040***	0.032**		0.025**	0.023***	
	[0.020]	[0.019]		[0.015]	[0.014]		[0.010]	[0.008]	
Post-primary	-0.054	-0.050		0.040	0.033		0.038	0.036	
	[0.039]	[0.040]		[0.049]	[0.048]		[0.033]	[0.029]	
Secondary or higher	-0.108	-0.090		-0.064	-0.034		-0.007	-0.017	
	[0.121]	[0.133]		[0.043]	[0.033]		[0.016]	[0.012]	

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Variables	Ever used Sur Eau			Currently using Sur Eau (self-report)			Currently using Sur Eau (self-report & chlorine resid.)		
	Coefficient [SE] [a]			Coefficient [SE] [1]			Coefficient [SE] [1]		
	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)	(1)[b]	(2)	(3)
Household wealth quintile (ref: poorest quintile)									
Poor-middle quintile	0.031	0.029		0.015	0.016		-0.002	-0.001	
	[0.029]	[0.029]		[0.019]	[0.019]		[0.008]	[0.008]	
Middle quintile	0.049*	0.046*		0.020	0.020		-0.002	-0.000	
	[0.026]	[0.027]		[0.017]	[0.017]		[0.011]	[0.011]	
Middle-rich quintile	0.146***	0.150***		0.036**	0.041**		0.012	0.018	
	[0.031]	[0.032]		[0.018]	[0.016]		[0.013]	[0.011]	
Richest quintile	0.180***	0.176***		0.058**	0.071***		0.026	0.026*	
	[0.045]	[0.044]		[0.028]	[0.024]		[0.018]	[0.015]	
Occupation of head of household (ref: other)									
Unemployed/retired	-0.047			-0.044			-0.045***		
	[0.057]			[0.027]			[0.016]		
Farming/agriculture	0.026			-0.016			-0.015		
	[0.042]			[0.028]			[0.018]		
Main drinking water source (ref: rainwater or other)									
Piped in residence	-0.223**	-0.260**		-0.083	-0.070		0.008	0.018	
	[0.098]	[0.106]		[0.068]	[0.065]		[0.028]	[0.025]	
Piped in public tap	-0.137**	-0.160**		-0.014	-0.013		0.034**	0.042***	
	[0.053]	[0.063]		[0.057]	[0.055]		[0.017]	[0.014]	
Inside well	-0.253***	-0.276***		-0.071	-0.064		-0.005	-0.000	
	[0.088]	[0.090]		[0.064]	[0.061]		[0.019]	[0.017]	
Public well	-0.148***	-0.167**		-0.011	-0.010		0.039**	0.049***	
	[0.054]	[0.065]		[0.055]	[0.054]		[0.017]	[0.015]	
Borehole	-0.218***	-0.233***		-0.026	-0.028		0.042**	0.050***	
	[0.065]	[0.073]		[0.060]	[0.057]		[0.021]	[0.018]	
Surface source (river/canal/lake/spring)	-0.070	-0.089		0.053	0.055		0.055**	0.064***	
	[0.059]	[0.067]		[0.062]	[0.061]		[0.022]	[0.020]	
Constant	0.250***	0.227***	0.081***	0.014	-0.043	-0.016**	-0.055*	-0.076***	-0.007*
	[0.083]	[0.071]	[0.025]	[0.071]	[0.056]	[0.007]	[0.032]	[0.023]	[0.004]
Observations	**2317**	**2373**	**2389**	**2322**	**2378**	**2394**	**2323**	**2379**	**2395**
R-squared	**0.321**	**0.315**	**0.288**	**0.102**	**0.098**	**0.077**	**0.059**	**0.055**	**0.043**

[a] Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

[b] This model also includes age, education, and religion of the head of household (coefficients not shown)

ANNEX B: REFERENCES

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